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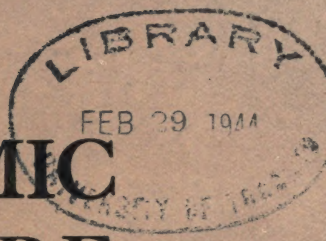

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EXPLANATION

The OPHTHALMIC YEAR BOOK containing Bibliographies, and the Digest of the Literature was established in 1904. OPHTHALMIC LITERATURE, containing the lists of current literature, was established in 1911. Both of these Journals were combined with other Journals in 1918 forming the American Journal of Ophthalmology, the Year Book portion being paged separately. In 1920 the Bibliographies and Digest of the Literature were published as a separate journal, OPHTHALMIC LITERATURE, quarterly.

This volume, continuous in numbering with the Year Book, will also contain the lists of "current literature," which have been heretofore published monthly in the American Journal of Ophthalmology. Subscribers who desire references to articles that have appeared subsequent to this issue, may, until the next issue appears, obtain them by applying to the Editor, 318 Majestic Building, Denver, Colorado.

The price for the two journals will continue as heretofore. The annual subscription price for OPHTHALMIC LITERATURE alone is six dollars.

OPHTHALMIC PUBLISHING CO.

Anterior Chamber and Pupil

WILLIAM R. MURRAY, M.D.

MINNEAPOLIS, MINN.

This section reviews the literature of 1920. Its literature frequently overlaps that of the uveal tract, and sometimes that of the visual tracts and centers. For previous literature see O. L. v. 16, 1920, p. 97.

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DIGEST OF THE LITERATURE.

ANTERIOR CHAMBER.—**Kahn,** in an article in reply to Seidel's remarks concerning physiologic pupil occlusion, shows that there is an obstacle to the passage of the current of fluid from the posterior to the anterior chambers and that this obstacle is due to the fact that the iris edge presses upon the anterior surface of the lens with some force.

In the normal eye, the changes in size of the pupil have great influence upon the passage of fluid and upon the mixture of the contents of the anterior and posterior chambers.

Koeppe, in the first paper of a series not yet concluded, details his methods of microscopic study of the angle of the anterior chamber. His methods are chiefly mathematic and results are expressed in mathematic formulas. He makes use of the Gullstrand Nernst Lamp, and his practical results will probably be published in a subsequent paper.

AQUEOUS HUMOR.— **Magitot** and **Mestrezat** found that, in man, the quantity of aqueous varies under normal conditions between 0.15 and 0.20 cm. In myopia the quantity is increased, while in cyclitis and sclerokeratitis there is no increase. In chronic glaucoma, the amount is slightly diminished, while in acute glaucoma the amount of aqueous may be reduced to almost nothing. It was found that the aqueous humor is chemically very much alike in domestic animals and man, and an analysis of the aqueous from the eye of the horse, showed that it resembles very much the cerebrospinal fluid, being rich in sodium chlorid and possessing very little, if any, albumin.

Hagen examined with the refractometer, the regenerated aqueous obtained by puncture of human eyes des-

tined for enucleation, and some others shortly after trephining for glaucoma and cataract extraction. He found that the regenerated human aqueous shows no higher percentage of albumin than the normal aqueous and does not contain fibrin. This is entirely at variance from the eyes of rabbits, in which the aqueous after the first puncture contains 4%; and after repeated punctures, e. g., the fifth, 5% albumin and fibrin, so that it coagulates almost instantaneously. Also in the dead, especially young persons, the anterior chamber is refilled within a few minutes, after puncture. Hagen examined this restored aqueous with the refractometer and found it not different from the first aqueous and the vitreous.

In the same way as in the human eye shortly after death, the vitreous fluid filtrates, after paracentesis of the anterior chamber of the living human eye, thru the zonula and fills the anterior chamber, to neutralize the difference of pressure.

Hagen explains the impermeability of the ciliary body of the human eye to fluorescein by the subordinate part which the ciliary body plays in the immediate restitution of the aqueous. He does not deny that finally the regeneration of the ocular fluids is a function of the ciliary body, but this regeneration occurs slowly, while the anterior chamber is filled in a few minutes. (See also p. 150.)

In reply to Hagen's article on regeneration of aqueous in the human eye, **von Hippel** states that, in several cases after opening of the anterior chamber for iridectomy, he has seen the vesicles of the ciliary processes which were described by Greef. Hagen mentioned in his article that neither he nor anybody else, according to the literature, had found these vesicles.

Girard and **Morax** experimented on rabbits by bathing the cornea with a solution of known electrolytic concentration. The head of the animal was connected with the negative pole and the fluid bathing the cornea was connected with the positive pole. It was found that magnesium sulphat caused a hypertension and barium chlorid caused a hypotension. There was a myosis present during hypotension as well as with hypertension. Changes in pressure were due to change in volume of the aqueous humor and changes in volume of the aqueous could be demonstrated by comparison with the untreated eye.

In the aqueous humor of the eyes of syphilitics, except when inflammation of the eyes existed, **Okazaki** succeeded in demonstrating a Wassermann reaction in the proportion of 1:200 or even 1:600 part of the blood contents. In the presence of inflammatory diseases of the eye, the antibodies appeared in an even higher concentration. The Wassermann reaction in the aqueous occurred just as soon as it did in the circulating blood.

By experiments **Myashita** has found that eserin, dionin, pilocarpin, cocain and silver nitrat increase the hemolysin in the anterior chamber, and that atropin, scopolamin, adrenalin and zinc sulphat diminish hemolysin in the anterior chamber. **Nakamura** also writes on changes in the anterior chamber from eye drops.

Guglianetti studied the viscosity of the aqueous humor in rabbits' eyes. He found that normal aqueous was almost of the same consistency as distilled water; 8 hours after paracentesis, the aqueous coagulated spontaneously; after 16 hours the viscosity was increased but coagulation did not occur, and after 24 hours the aqueous regained its normal characteristics; the presence of lens substance in the anterior chamber, following discission, increased the viscosity of the aqueous; subcutaneous injections of iodin preparations, in nontoxic doses did not change the viscosity of the aqueous.

Cyst in the Anterior Chamber.—**Strader** described a cyst in the anterior chamber which had followed a penetrating wound at the corneal margin, with prolapse of the iris. The cyst occupied the upper-outer fourth of the anterior chamber. The eyeball was inflamed and irritable. Tension was normal.

Stevenson describes a case of cyst of the iris, which had the peculiar faculty of appearing in the anterior chamber when the head was bent forward and

disappearing into the posterior chamber when the head was in an upright position. With the head upright, the only abnormality was an area of discoloration extending from the pupillary margin downward to the base of the iris and in the same position behind the iris was a small, dark patch, somewhat wider than the discolored area on the anterior surface. There was no irregularity of the pupil and there was normal pupillary reaction. On bending the head forward, a greyish brown body appears in front of the iris, extending downward nearly to the bottom of the anterior chamber and on raising the head, this dark fluid gradually rises and slips back over the edge of the iris into the posterior chamber.

Persistent Pupillary Membrane.—**Schwenk** describes a case of persistent pupillary membrane present in both eyes of a girl fifteen years of age. On general examination, the pupils appeared normal, but after the use of a mydriatic, the pupils were irregular and showed bands attached to the iris, crossing the pupil and adherent to the lens capsule in the pupillary area and giving the appearance of a brownish membrane on the lens. **Shields** also described a pupillary membrane, in a man 28 years of age, whose eyes were normal except for a deposit of brownish dust like particles on the anterior surface of each lens.

Takao saw a patient with pupillary membranes in both eyes. The membrane was on a plane with the anterior surface of the iris, and had an opening in the middle in front of the true pupil.

Axenfeld reports a case of movable pupillary membrane in a young man who complained of diminished vision when in a bright light. Examination showed pupils slightly irregular, reaction normal and a greyish color in the pupillary areas, which largely disappeared on looking upward. Under lateral illumination, there was seen a pupillary membrane, which was thrown into folds when the pupil was contracted. With a dilated pupil, the membrane became smooth and more transparent, so that the fundus could be seen. With a Zeiss binocular magnifying glass, it was seen that the membrane was not in connection with the anterior surface of the iris, but was attached to the posterior surface similar to posterior synechiae. Axenfeld assumes that it was of prenatal origin or occurred during infancy.

Artificial Pupil.—**Ziegler** reviews the history of iridectomy operations showing that the advocates of this operation were divided into two schools, one advocating the use of the knife needle for incising the membrane, and the other advocating the excision of a piece of the iris membrane with scissors introduced thru a corneal wound. The advantages of the knife needle operation, as enumerated by Ziegler, are ease of incision, lack of traction on the ciliary body, freedom from postoperative inflammatory reaction, lessened tendency to iris hemorrhage from lowered tension, the avoidance of opening an eyeball with fluid vitreous and the avoidance of a scar. The disadvantages of the scissors method are given as greater difficulty in operating, greater traumatism, more frequent loss of vitreous and more severe inflammatory reaction.

Pupillary Centers.—**Spiller** states that, while there is evidence as to the location of the oculopupillary fibers of the sympathetic system in the cervical cord, medulla oblongata and pons, there is scarcely anything known of these fibers in their relation to higher parts of the brain. He refers to experimental work of himself and others and concludes from it and from his study of clinical cases; that the sympathetic fibers of the eye may be paralyzed by a lesion of the pons, and that in man the oculopupillary fibers do not decussate, or at least in very slight degree, in the pons or below this in the medulla oblongata or cervical cord.

Dunn cites a case of sudden blindness, due to embolism of the central retinal artery, with absence of direct pupillary reaction to light stimulus at the first examination, a few days after the onset of blindness, and the presence of direct response of the pupil to light one month later, altho no improvement in vision had occurred. The return of the direct pupillary reac-

tion is attributed to the disappearance of the retinal edema, thus allowing the action of light stimulus upon the retinal pigment layer. Dunn believes that the direct response of the pupil to light is a primary reflex, accomplished without recourse to the intact optic nerve and intracranial pupillary pathways, and that it is an extracerebral reflex, its nerve pathways being from the retinal cells to retinal pigment cells, along the pigment layer to the ciliary region where sensory impulses are aroused in the sensory nerves to the ciliary ganglion, thence along these ciliary sensory nerves to the ciliary ganglion in the substance of which impulses are aroused in the motor cells of the ganglion, which impulses passing outward, result in contraction of the pupil. He thus explains the phenomena of the Argyll-Robertson pupil, of the behavior of the pupil in the second stage of ether anesthesia, and of the pupillary phenomena which precede death.

Following intravenous injection of adrenalin, **Byrne** obtained paradoxic pupillary dilation as follows: (1) In the contralateral pupil after (a) section or alcoholic injection of one sciatic nerve; (b) section of dorso-spinal L vii—S ii.

(2) In the homolateral pupil after (a) hemitransection of the spinal cord in upper or lower cervical, or in lower thoracic or upper lumbar segments; (b) section or alcoholic injection of the brachial plexus; (c) section of the posterior spinal cervical roots. From his studies, the following conclusions are drawn:

1. As the histologic changes, degenerative and regenerative, that take place in the dorsal root ganglia after sciatic section closely coincide in time and extent with the appearance and disappearance respectively of the paradoxic pupil phenomena, it seems these latter are conditioned by the functional activity of the neurone bodies of the dorsal root ganglia and more especially of the smaller neurone bodies, which give origin to the unmyelinated pain-bearing fibers of the peripheral nerves.

2. From all regions of the periphery, in the waking state, a flow of afferent impulses impinges on the upper thoracic segments conditioning the efferent flow from the cord to the dilatator pupillae.

3. The efferent flow from any region of the periphery probably affects both pupils but because of unequal anatomic distribution, one pupil is more affected than its fellow.

4. No evidence has been found of the existence of cerebrospinal dilatator pathways in the cervical spinal cord.

Pupil Measurements.—**Landolt** calls attention to the clinical importance of observing and recording pupillary measurements and reactions under definite and constant conditions and for the proper comparison of the pupillary measurements of different individuals or of the same individual at different periods, he considers it essential to be able to record the results in figures. This he does by means of graphs and illustrates the method by citing clinical cases to show the practical value of such records. **Hartridge** has discussed the shape of the pupil in various animals, and **Hinrichs** the significance of its location in the human eye.

Mydriasis.—**Pollock** found that pituitrin, when dropped into the eye of the rabbit, produced a mydriasis in about 94 per cent of the experiments. This mydriatic effect was increased slightly by decentralization of the dilator pupillae or of the sphincter pupillae; to a greater extent by deganglionation; and most markedly by deganglionation of both dilator and sphincter pupillae. When pituitrin was administered intravenously, it was found that the local mydriatic effect was lost if the blood pressure was raised, in which case a myosis occurred, due to central stimulation of the third cranial nerve. Results of Pollock's experiments showed that dilatation of the pupil is a local action of pituitrin, which may act either on the persisting peripheral plexus or upon the muscle directly, thus resembling the action of adrenalin.

Cockcroft cites two cases in which adrenalin was instilled into the eye to

determine, by Leowi's reaction, whether pancreatic insufficiency was present. Case 1 was carcinoma of the bile ducts and liver without involvement of the pancreas. Adrenalin chlorid sol. (1-1000) was dropped in one eye and gave no reaction, the pupils remaining equal. Case 2 was malignant disease of the head of the pancreas and adrenalin chlorid dropped in one eye was followed by marked mydriasis.

Kato and **Watanabe** have established the fact that mydriasis occurs without exception in cases of chronic nephritis as well as occurring in pancreatic diabetes, Basedow's disease, diseases of the peritoneum, the abdominal organs and diseases of the meninges and brain. They have also found that it occurs frequently in arteriosclerosis, beri-beri, and at times in bronchial asthma and various diseases of the spine. Adrenalin 1 per cent solution is dropped into the conjunctival sac of one eye at intervals of five minutes and after a lapse of a certain time, examination is made as to size of pupils. The pupil begins to dilate in from five to fifteen minutes after instillation and attains its maximum in one to two hours in weakly positive cases, while in cases with a strong reaction, traces remain even after thirty hours. The pupil reaction in chronic nephritis is not dependent upon the amount of albumin in the urine, but rather upon the blood pressure. In acute nephritis, the adrenalin mydriasis occurs only exceptionally, occurring only twice in twelve cases. The instillation of adrenalin in normal individuals did not cause mydriasis.

Observations of **Marbaix** demonstrate that in the presence of a unilateral mydriasis of the pupil in a syphilitic adult, even if the blood Wassermann is negative, it is not permissible to stop treatment nor to permit marriage of the patient without examination of the cerebrospinal fluid. He believes that the mydriasis is an indication that syphilis is active altho the blood Wassermann is negative. **Aurand** reports mydriasis following herpes.

Miosis.—**Kato** and **Watanabe** made repeated subcutaneous injections of epinephrin and obtained contraction of the pupil, instead of the usual dilatation. They found that it did not occur when the eyes were under the influence of atropin or when epinephrin was injected for the first time. The contraction probably resulted from chemical changes in the muscles controlling the pupil.

In enumerating the premonitory symptoms of tabes, **Fuchs** mentions myosis as an important sign of incipient tabes and says it is present in one-half or one-third of the cases with reflex immobility. The myosis is attributed to degeneration of the cilio-spinal center, which prevents its transmission of the stimulus from the centripetal nerves to the sympathetic and to the dilator.

Hyatt, McGuigan and **Rettig** refer to the wide divergence of statements regarding the condition of the pupil in chloral poisoning and believe that this difference is due to the fact that but little actual investigation has been made of this particular phenomenon. In their study of the action of chloral on the pupil, frogs and mammals were used and the drug introduced intravenously. It was found that small doses produced a condition resembling normal sleep, with slightly contracted pupils. This was due to removal of the inhibitory effects of the higher centers from the oculomotor center. Large doses caused pin-point pupils. Definite experimental evidence was found to show that no part of the mechanism of the eye peripheral to the ciliary ganglion is directly acted on by the chloral, but that the action is central and due to removal of inhibitory influences which are normally active. It was also found that the intravenous use of adrenalin caused a quick and constant dilation of the chloral constricted pupil, which persisted after the blood pressure failed to react to intravenous injections of adrenalin, indicating that the sympathetic innervation of the eye is more sensitive to adrenalin than the sympathetics to the blood vessels and proving that the sympathetic nerves to the radiating fibers of the iris are

not paralyzed by the action of chloral and that they are but little, if any, depressed.

Zsako agrees with Professor Kenyeres, who states that when the eye of a cadaver is protected against possible evaporation thru closing of the eyelid, but the other eye is left unprotected, distinct differences in the size of the pupil can be noted in a very short time, which means that in the open eye, the pupil diminishes in size very rapidly. He observed these same changes in twenty cases and also noted that when the evaporation was accelerated thru increase in temperature and changes in the air current, the difference in size of the pupils was more quickly apparent. He also aspirated a part of the vitreous thru a corneal puncture and observed that with decreased tension, miosis occurred. Pressure on the eyeball, together with aspiration of vitreous, caused a more rapid miosis, which Zsako believed was caused by the pushing forward of the lens.

Lowenstein reports experimental investigations on katatonic pupillary changes.

Mazzei found that when aqueous extracts of testicle, spleen, liver, brain, muscle, pancreas, or lymphatic ganglion, were injected into the anterior chamber of dogs myosis resulted, and the action of atropin was retarded. Alcoholic extracts of the same tissues or solutions of peptone did not produce myosis. (See also p. 151.)

Physiologic Pupillary Reactions. —**Weve** disagrees with the theory of Carl Behr, published in 1913, of the participation of both halves of the retina in the light reflex of the pupil. In its original form, Behr's theory is that the isolated irritation of the nasal half of the retina causes a direct pupillary diminution exclusively, while isolated irritation of the temporal half causes an indirect or consensual reaction. Contrary to this theory, it was the common opinion that isolated irritation of either half of the retina might cause an indirect reaction as well as a direct reaction. Carl von Hess, in 1907, showed that by extending the right light reflex from the macula to the adjoining parts of the retina, no demonstrable direct or indirect pupillary changes could be produced, but that they occurred when the light was directed toward the fovea. His conclusions were that the parts of the retina adjoining the optic nerve upward, downward and outward have none or only very little pupillomotor function and that only a very small part of the retina has any such function. Von Hess also found that the nasal and temporal retinal halves cause direct as well as indirect reaction. Weve's findings are in harmony with the results given by Hess for the first phase of pupillary reaction and he concludes that for both retinal halves there is a complete parallelism between direct and indirect reaction; that temporal and nasal reactions are equally great in a large majority of cases; and that in a smaller number of cases the nasal half predominates, for the direct as well as for the indirect reaction, over the temporal. These results are in direct contradiction to Behr's hypotheses.

Cemack describes an otogenic pupillary reflex which is caused by the action of sound. The reflex is best induced by the sound of a tuning fork. A rapid narrowing followed by a slow dilatation of the pupil occurs. The author found the reflex in 27% of normal persons. It is present in some deaf mutes who have remnants of hearing.

Domarus reports a case of a healthy young woman whose right pupil did not react to light. It reacted promptly to convergence when looking at an object near by, after which twelve to fifteen seconds were required for the pupil to dilate when looking into the distance. According to the author, the novel feature of this case is the fact that there was no evidence of syphilis or other cause for this condition.

Ruttin found that the pathologically wide pupil is contracted by the faradic current when the lesion is central and is not influenced when the lesion is peripheral.

Pathologic Pupil Reactions.—**Dercum** and **Gilpin** studied the pupillary

reactions in a case of brain tumor. The left pupil was immobile to light, the right pupil failed to respond so long as the light was thrown on the blind half of the retina, but responded by contracting when the beam of light was thrown on the side in which vision was preserved (patient had left homonymous hemianopsia). A small pocket light throwing a narrow beam was used. After ten days, the response became markedly less and finally disappeared so that the right pupil, like the left, became fixed to light. The tumor was probably so situated as to give rise, in a moderate degree, to cerebellar symptoms and at the same time was so far forward as to invade the optic tracts in relation with the primary optic centers or possibly these centers themselves. Dercum has seen the Wernicke sign four times and in one instance, the clinical report was accompanied by necropsy findings.

Franke reports a case of inequality of the pupils with sluggish reaction, which produced a case of encephalomyelitis complicating grippe. The pupils were irregular and unequal and reacted very sluggishly to light and convergence. After three months, the reaction was sluggish and the irregularity and inequality of the pupils remained.

Blumenthal refers to the course of the sympathetic nerve as being exposed to most various mechanical influences. Its tonicity is subjected to all sorts of variations and hence, one may expect disturbances more easily than to the motor oculi and a large part of these disturbances, often of insignificant sort, find expression in an altered state of the pupil. Fibers of the chest and neck sympathetic enter into the spinal cord and gain important relations to the center of the oculomotor extending into the dorsal section of the spinal cord.

Enlargement of the thyroid and lymph nodes of the neck can, thru pressure, irritate the neck sympathetic and dilate the pupil on the same side. The most frequent cause of unilateral pupil dilatation, with well preserved light and convergence reaction, is a diseased process in the region of the upper part of the pleura. Inflammations leading to contractions injure and irritate the sympathetic filaments which pass directly over the apex of the lungs to the center of the oculomotor. This is best known in tubercular lung apex diseases which lead to a fibrinous inflammation of the apex of the pleura, and years afterward, the pupil inequality may remain and offer a diagnostic criterion. The author concludes that more or less decided inequality of the pupils is quite frequent and one of the principal causes is disease of the apex of the pleura or its exits. This is by no means rare in pleuro-pneumonia of sections of the lungs and in tuberculous lung diseases.

Nicolau believes that inequality of the pupils, occurring in the primary stage of syphilis, has not received proper attention and states that it may occur as early as the fourth week from the onset of the primary sore. From a prognostic standpoint, the author believes that persistent inequality of the pupils ought not to be regarded as definitely constituting a menace for the patient's future but that it is a symptom that should be carefully watched as it probably indicates some involvement of the nervous system.

Rasquin studied 824 cases of irregularity of the pupil, of undoubted syphilitic origin, with special reference to the form of the irregularity. In 107 cases, he found the forms described by Brown-Séquard and Terson, consisting of elliptic or oblong deformity, but does not consider this type of irregularity as pathognomonic until advanced to a certain degree, as many normal pupils show an oblong irregularity. When this deformity was pronounced, it was found that in most cases, altered reflexes were present (96 times).

In the series of cases studied, the most frequent irregularity found was that which showed a definite angular margin (79%). It usually involved a large part of the pupil, giving it the aspect of a polygon; was found in all stages of syphilis and was most often present in both eyes. Most importance was attributed to the multiangular pu-

pil because it represented a pathologic condition found in all stages of syphilis; it was the most frequently present; and it represented the advance in the researches of the syphilitic origin of the pupillary irregularities. The diagnosis of syphilis was always confirmed by examination of the blood or cerebro-spinal fluid or by the luetin reaction of Noguchi.

Fleischer and **Niesenhold** state that traumatic immobility of the pupil is generally due to disturbances of the conduction of the motor impulse to the sphincter. They cite a case of a young girl whose left lower lid was injured. There was complete paralysis of the oculomotor nerve with widely dilated pupil, and incomplete unilateral immobility with almost complete abolition of direct and diminished consensual reaction to light. The diminished consensual and almost complete disappearance of direct reaction was attributed to the partial optic atrophy, the authors assuming that there was a special damage to the pupillary fibers of the optic nerve. They also assume that on account of the greatly impaired direct and the diminished consensual reactions, there was a feeble impulse of convergence, thru the existence of special convergence fibers which escaped injury, while the light reaction fibers were damaged. **Lowenstein** reports loss of pupil reflex thru trauma.

While the absence of pupillary reflexes to light is of importance as a sign of metasyphilitic disease of the central nervous system, **Strohmayer** calls attention to the fact that it may be due to other causes and cites cases to show that it may, in some instances, be due to a rare familial tendency. **Kempner** and **Westphal** report on hysteric pupillary disturbance.

Kato and **Watanabe**, while investigating the results of stimulation of the sympathetic nerves, found that a very dilute solution of adrenalin, under certain conditions, caused a constriction instead of a dilatation of the pupil and they carried out a series of experiments on cats to ascertain the conditions causing this phenomenon.

They found that in cats which were previously treated with daily successive hypodermic injections of adrenalin for some weeks, the injection of a minute quantity of adrenalin into the carotid caused a constriction of the pupil, while by intravenous injections, no such paradoxic effect was obtained. In the pupil of such treated animals, constriction usually occurred after the instillation of adrenalin. When the animals had not been previously treated with repeated administrations of adrenalin, the paradoxic action of adrenalin on the pupil was only rarely observed. Instillation of adrenalin in the eye was always followed by miosis lasting from five to eight hours in animals previously treated daily for several weeks with successive instillations of adrenalin instead of by hypodermic administrations. They believe that the paradoxic action is based on the altered chemism of the dilatator muscles of the pupil.

Georgopoulos observed alternating inequality of the pupils in 5 cases. It is the author's opinion that the condition is due to irritation of basal pupillary arc thru the sympathetic system. The source of irritation is in the thorax or neck and the impulses are transmitted thru the thoracic cervical ganglia. **Wodak** reports on the vestibular pupillary reflex.

Junius had a patient who had a disturbance of the pupillary reflexes and syphilis. The man had recently recovered from grippe. Junius was unable to determine whether the pupillary phenomenon was due to syphilis or grippe. **Nonne** reports absence of pupillary reflex in congenital lues.

ARGYLL-ROBERTSON PUPIL.—**Rasquin** and **Dujardin** emphasize the importance of the A-R pupil as a sign of lues and believe that it does not occur without a syphilitic taint. They advise that in all cases where this sign is present the following tests be made:

1. Bordet-Wassermann blood test.
2. Reactivation in cases in which the Bordet-Wassermann is negative.

3. Lumbar puncture with examination of the cerebrospinal fluid as regards tension, lymphocytosis, quantity of albumin, nature of globulins, and Bordet-Wassermann test.

4. As an accessory, the luetin test. They examined 85 cases of Argyll-Robertson pupils, which did not show any other symptoms of syphilis, and divided the cases into three groups as follows:

1. With symptoms of meningeal irritation. 2. Without meningeal reaction, but with positive Bordet-Wassermann blood reaction. 3. Without meningeal reaction and with negative Bordet-Wassermann.

The prognosis depended upon the group in which each case was included.

Vedsmond, in determining the part played by syphilis as an etiologic factor in hemiplegia, considered as syphilitic all cases showing the A-R symptom-complex, and included them among the syphilitic cases even tho the Wassermann reaction was negative and the cerebrospinal fluid was normal. **Cabannes** declares that the A-R sign may be encountered with any lesion of the centripetal arm of the pupil reflex, not necessarily of syphilitic origin, or in tabes or general paresis.

Magitot and **Bollack** observed a patient who was operated for orbital angioma and following the operation there was limitation of movements of the eyeball and a dilated left pupil, which reacted normally. Three months after the operation, the movements of the eyeball were normal, but direct and consensual pupillary reflexes were abolished. Convergence reflex was present. The authors admit the possibility of a peripheral origin of the A-R pupil. Discussing the above Rochon-Duvigneaud had also seen an Argyll-Robertson pupil after contusion of the eye-ball, and Dupuy-Dutemps had observed a patient with an eye injury which showed a reversed A-R sign.

Fuchs states that tabes is preceded by premonitory symptoms which he divides into pupillary signs, paralysis of the motor oculi, and atrophy of the optic nerve. Under pupillary signs, he mentions the Argyll-Robertson pupil, one of the earliest and most common signs of tabes, and present in 70 to 80 per cent of cases. The location of the lesion that breaks the reflex arc is most probably in the tract of the pupillary fibers of the optic nerve on their course to the nuclei of the abducens, namely in the vicinity of the aqueduct of Sylvius above the posterior longitudinal bundle. Fuchs states that reflex immobility of the pupil is an almost exclusive sign of syphilitic or parasyphilitic infection of the nervous system.

Lowery and **Benedict** reviewed 275 cases of neurosyphilis to determine the percentage of cases in which pupillary and reflex disorders were present.. In their series of cases the Argyll-Robertson pupil was present in 40.7%; in 11.7% there was a spastic reaction to light and accommodation; 10.5% showed impaired reaction. Normal pupillary reactions were present in 28.7%. Their findings show that about 7 in 10 cases of neurosyphilis will show some abnormality of pupillary reaction; 5 in 10 will show a stiff pupil; and 4 in 10 will show an Argyll-Robertson pupil. 29% of the cases showed anisocoria, while irregular pupils were present in 49%. The combination of unequal and irregular pupils occurred in a surprisingly small number of cases and the authors believe that irregular pupils are of more diagnostic import than unequal pupils, since the number of possible causes is less and the necessary lesion rather more severe.

HIPPUS.—**Fleischer** observed a case of veronal poisoning in which he could confirm symptoms which Roemer had previously mentioned in 1919. The pupils were constricted and did not react to light. Corneal reflex was absent, epigastric and patellar reflexes were present. During the following few days, he observed the fluctuation in the pupils, now contracting and then expanding. **Dimitz** and **Schilder** have written on pupillary nystagmus.

Roemer, in his experimental investigations of the pharmacology of veronal, was unable to confirm the findings of Gröber who had observed peculiar changes in the pupils of cats after poisoning with veronal. The Gröber ob-

servations, however, caused Roemer to give special attention to probable pupillary changes in man in veronal poisoning, and he found present in all cases the phenomenon designated as hippus and believes this sign to be an important and typical sign of veronal poisoning. He has observed 12 cases of veronal poisoning and in 10 of the cases, there was spontaneous changing of the pupil size. In one case there was absence of the wavering of the pupil but in that case, there was a combination of morphin and veronal poisoning. Roemer considers hippus as a valuable diagnostic symptom of veronal poisoning, not found in cases of poisoning by other narcotics or hypnotics. He also confirms the observations of Bunke that therapeutic doses of sulphonal, trional and veronal do not influence the pupils.

The Uveal Tract

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This section reviews the literature for 1920. Sympathetic disease is considered separately in the next section. Many uveal diseases are included among the ocular lesions of general diseases and are referred to under that heading. For previous literature see O. L. v. 16, 1920, p. 103.

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DIGEST OF THE LITERATURE

ANATOMY.—**Fusita** complains that only the surface parts of the choroidal capillaries have been thoroly studied. The capillaries are capable of such extension of lumen that great expansion can be attained even to the passage of ten corpuscles at one time, especially in the region of the macula. They are very closely meshed. As the capillaries are well filled with blood they look very red when stained with hematoxylin-eosin. The choroid is in a certain sense a cavernous tissue. The arteries which connect with the short ciliary artery come into the choroid and there separate at once into several capillaries, quickly becoming a mesh of capillaries. At the posterior pole the vessels come in obliquely, and run at first laterally, for which reason the choroidal tissue is there thicker than at other places. The spaces of the capillary mesh are filled with connective tissue so that the surface is even thruout.

Kraemer observed in a boy, aged 4, with pale discs and very much impaired vision, an atypical temporal oval with large conus downward and toward the temporal side. Between the upper and middle third of the conus runs from the stem of the inferior vein immediately below its emergence from the optic nerve, a vein larger than the vessels of the first order, forming a loop on the conus. At the end of this loop its character as a retinal vein is suddenly lost and without interruption it proceeds with the typical signs of a choroidal vessel in color and width for a distance more than the diameter of the disc into the fundus. Upon pressure on the eyeball the central part first becomes pale, earlier than the retinal veins proper, according to simple hydrodynamic laws. By this pressure the current of the retinal blood is retarded, the retinal efferent passages narrowed and the blood stream in the optico-ciliary vessels is reversed toward the choroid, while the blood in the retinal veins finds no other outlet. Thus the pressure in the optico-ciliary vessels sinks much more rapidly than in the retinal veins, and the compression sets in earlier.

The dilatator iridis of the crocodile, according to **Grynfeltt** and **Carrerè** consists of a musculo-epithelial membrane, whose basal part arises from the pars iridica retinae. The contractile fibres are very long, loose and parallel, following the radial structure of the iris. They are simple striated fibres. The sphincter is highly developed. At the margin of the pupil, its striated fibres form a closed ring, are strongly pigmented and on sections which have not been depigmented, resemble the posterior iris epithelium. After depigmentation, a delicate, superficial striation of the sarcoplasm can be seen. Toward the ciliary region, the pigment gradually disappears and the cross striation becomes complete.

ANOMALIES. PIGMENTATION. — **Mas Soewarno** deals with the different types of iris pigment in man, the structure of the iris tissue and pigment distribution, kinds of pigment as regards form, chemism, physiologic action and relation in different races, and heterochromia. with experiments on rabbits. He thinks that investigations regarding changes and injuries to the eye by light rays should help our insight into the causes of heterochromia. Then he takes up the albinotic iris, circumscribed depigmentation of the iris, glaucomatous depigmentation, and thru general diseases, e.g., lues. In 7 out of 29 luetic patients who showed more or less distinct changes in the iris, depigmentation could not be followed in its entirety. Small gray or yellowish white foci appeared in the ciliary zone of the anterior surface of the iris, which may coalesce to maplike fields often with finely pigmented borders. In the great majority the white spots were seen in the secondary stage. Seventeen of the cases had syphilitic leucoderma. Both affections should be regarded as equivalent. Inflammatory conditions were never seen. They may be caused by impoverished blood supply as the result of the general disease. **Swift** presented a girl of 11 years in whom the iris in both eyes had no color in the stroma,

iris tremulous and fundus negative. **Chery** reports binocular aniridia.

Waardenburg compares the various theories with regard to diversity of color in irides, and describes 7 cases in which it accompanied paralysis of the sympathetic nerve. Out of his 73 cases of heterochromia in man, in 37 only one iris showed a diversity of coloring. In 5 there was melanosis of one eye and in 6 other anomalies in the eyes. **Perrin** has written on the color of the eyes.

Würdemann examined a girl, aged 16, a typical brunette with brown eyes of even color, but pigmentation of the somewhat bluish sclera of the left. After nine and one-half years there was a general change of her countenance and one-sided pigmentation of the left eye and surroundings. The right iris was light brown and had distinct markings, the left very dark seal brown with no distinct markings. The right sclera and conjunctiva were normal, the left sclera blotched with pigment and the conjunctiva had pigment patches similar to those sometimes seen in old negroes and more particularly in half castes with speckled skins. A peculiar bluish-black discoloration of the eyelids on the left side extended above the temple to the forehead. The ethnologic aspect was such that a diagnosis of a color reversion from an infinitesimal amount of negrism was apparent to the educated eye.

Streiff adds the following synopsis of facts of his elaborate observations and reflections on the problem of heterochromia: (1) There is a congenital uncomplicated permanent heterochromia. (2) The congenital heterochromia may, in rare cases, show congenital cataract. (3) Generally, opacity of the lens and deposits appear in later years. (4) Often the heterochromia is not observed, but in later years the complications appear usually at the third decennium. (5) The precipitates develop very insidiously, without irritation of the eye. They are very fine, frequently not rounded but indented, of unusually white color, irregularly dispersed, numerous or scanty, and resist any therapy. (6) Cataract also occurs without, but mostly with, precipitates; generally in the second and third decennium. (7) Atypically it may be complicated by real malformations. (8) In partial heterochromia often dots of pupillary membrane may be encountered on the anterior capsule, sometimes only on the side of the darker pigmentation of the iris. (9) In partial heterochromia and melanosis frequently Fleischer's verrucae are met in the area of the iris pigmentation. (10) Also partial heterochromia presents frequent complications; higher astigmatism, nasal partition of vessels, opaque nerve fibers, amblyopia. (11) In complicated heterochromia, clinically atrophy of the iris of the lighter eye is missing, but anatomically there is decided lack of cells of stroma pigment and of any inflammatory processes. (12) In heterochromia seldom are there symptoms of the sympathetic nerve. More often pareses on the side of the lighter eye are disclosed. They accompany mainly congenital heterochromia, rarely cases with complications, and are not typical (13) Only in rare cases heterochromia occurs by subsequent depigmentation. (14) Glaucoma is very rarely observed as an ultimate complication of heterochromia.

Bettremieux writes that heterophthalmia is not a simple caprice of nature, but a symptom of a latent malady of the eye which began during embryonic life, and is probably the result of disturbance of the circulation in the iris. **Lindberg** and **Carreras** also write on heterochromia.

MELANOSIS.—**Chance** found in a man a bluish gray mass in the right iris filling the angle of the anterior chamber at the nasal side. The pupil showed a notch at the site of the mass, and on full mydriasis the mass projected into the pupillary space. There were no signs of inflammatory reaction and no pain. Tension was not increased. Chance offered it as a case of melanosis, which, altho at present benign, might become malignant.

Jablonski presented two sisters with congenital melanosis of the sclera. The pigment showed several signs of abnormally intense pigmentation. Further peculiarities were bilateral occurrence, combination with bluish, ab-

normally thin sclera and impairment of function. In the one case the more melanotic eye was by far more myopic. Symptoms of melanosis of the eye are: dark speckled or diffuse discoloration of the sclera, intensely pigmented iris with uniformly felty or warty surface, dark fundus, and generally unilateral occurrence.

Experimental Depigmentation.—**Vogt** produced in rabbits by isolated short-waved ultrared, with admixture of red rays, depigmentation of the iris near the pupillary margin which appeared as a white ring. In the course of weeks one could see how the pigment was exfoliated and fell into the anterior chamber. Also paralysis of the sphincter seemed to occur regularly. The pupils of the radiated animals showed maximal mydriasis. These experiments may elucidate the useful or nocuous qualities of modern sources of light which differ from daylight by their greater content of ultrared, not, as so far supposed, of violet and ultraviolet. The ultrared of daylight is only a minute fraction of our artificial lights.

Koyanagi's experiments on the effects of stings of wasps and bees on the eyes of rabbits showed the following results, which, according to Koyanagi's opinion may also be applied to the human eye. Intense damage to the sphincter muscle by direct toxic action producing swelling and formation of vacuoles in the muscle, with subsequent mydriasis. Proliferation of the corneal endothelium spreading upon the iris leading to adhesions between the iris, especially its root, and the posterior surface of the cornea. Koyanagi attributes to this the late mydriasis in some of his cases, by the iris being drawn towards the sinus of the anterior chamber by these adhesions. Depigmentation of the iris from degeneration of the vascular walls and the chromatophores in the anterior layer of the iris.

Proliferation of Pigment.—Proliferation of the ciliary epithelium is rather frequent in hypertension of long standing. **Fuchs** observed it in a congenitally myopic eye of a boy, aged 11, with other congenital anomalies, who had sustained two injuries within three months. The proliferation started from tear of the pars ciliaris and spread forward over the whole iris and a portion of the posterior surface of the cornea, backward over the largest part of the lens. Here it was intensely pigmented, imparting to the lens a black aspect similar to the pigmented secondary cataract described by Brückner (Klin. M. f. Augenh., v. 62, p. 461).

Koeppe claims that in 1917 he wrote, prior to Vogt, of the ring-shaped opacity of Vossius on the anterior capsule completely imbibed with dark pigment dust, while the pupillary margin appeared without defects. He assumed that at the moment of impact the accidentally narrow pupil was pressed against the capsule and a part of the pigment of the pupillary ring adhered and became visible when mydriasis developed. **Vogt** again emphasizes that only by anatomic examination can it be determined whether this ring consists of pigment.

Roll showed a patient whose right eye showed from infancy a number of vessels on the front of the iris converging from the periphery to the margins of the pupils. The eye was blind and disorganized, and having recently become painful, the patient was anxious to part with it. In the discussion Treacher Collins thought the condition was probably the persistence of fetal vascular system, and believed there would be found after enucleation a patent central hyaloid artery.

Coloboma.—**Holloway** exhibited a child, aged 12, with bilateral colobomata of iris and choroid down and slightly in. A few delicate zonular fibers could be noted below stretching between the notched border of the lens and the ciliary body. The apex of the very large choroidal coloboma was sweeping just above the disc. The course of the vessels was very irregular here and there, showing marked dipping. There were vague splashes of delicate pigmentation over the colobomatous area. An unusually large number of vessels, doubtless socalled scleral vessels, coursed down over it towards the periphery. **Gifford's** case

was what he believed the first case reported of coloboma of both iris and choroid up. Theoretically, it is conceivable that the lagging growth, whatever its cause, might begin at any stage of development of the optic cup, when it was hardly a cup at all, and that such a defect might allow mesoderm to enter the cup which would persist and cause a defect very deep in the choroid. **Van Duyse** and **Lindahl** suggest such possibilities.

Waddy reported a case of coloboma of the iris, ciliary body, choroid and optic nerve. The child, aged 10 years, had been weakly since birth. There was rapid horizontal nystagmus aggravated by fear, or excitement. A partial coloboma of the right iris extended from the margin of the pupil downward for 3 mm., but not to the outer margin. No involvement of the lens and vitreous. A typical coloboma of the choroid extended to the lower margin of the disc, which was not implicated. The coloboma extended downward in the shape of a fan towards the equator, beyond which it extended, probably involving the ciliary body. The surface of the colobomatous area was snow-white and was traversed by retinal vessels, a few choroidal vessels appearing here and there at the sharp pigmented border. The retinal vessels were apparently healthy and the macula was not affected. In the left eye there was a triangular lenticular opacity, directed downwards and inwards. The opacity was confined to the posterior cortical area and possibly the capsule. It did not reach so far as the equator of the lens. The vitreous was clear. A coloboma extended above the optic nerve for a distance equal to the diameter of the disc. It presented appearances very similar to those of the coloboma of the choroid in the right eye, but was considerably larger.

There was a large coloboma of the optic nerve. The disc had a horizontal and flattened appearance, with vessels issuing from the upper and lower margin of the neural coloboma. The macular region was unaffected and the retinal vessels were normal. There was a low degree of hyperopic astigmatism. Waddy stated that the first coloboma of the iris was recorded in 1673. The condition was congenital, due to developmental error in connection with the closure of the fetal cleft in the early months of embryonal life. A coloboma not infrequently ran from the pupillary border to the optic nerve and involved all structures of mesoblastic origin. Occasionally accessory atypical colobomata were also present. In this case were some cicatricial bands of very white tissue below the left disc. **Stajduhar** reports atypical coloboma of the iris.

Lindberg describes four cases of congenital indentations of the pupillary margins at the ages of 43, 37, 16 and 13 years. These, with a case of Gilbert, and perhaps one of Bernheimer, are the only ones so far published. They occur in otherwise normal eyes in numbers of from one to nine and are ascribed to developmental disturbances of the rim of the ocular cup. Either certain indentations persist or impediments which in form of vascular connective tissue prevent the advancing growth of the rim of the cup, also on places which differ from those determined by the peculiar conditions of growth of the embryonic eye. Only gradual differences exist between the indentations of the rim of the cup and the atypical colobomas of the iris and ciliary body. One may even think of the probability that partial and total aniridia may be nothing else but the results of numerous embryonic indentations of the pupillary margin. Thus indentations, colobomas in different directions and aniridia would be only varieties of the same malformations in which, aside from abnormal growth of the ectodermal portion of the cup, also the vascular connective tissue, at least in later stages, may be of importance. **Levinsohn**, in reply to Lindberg's article, remarks that he described the first case of this kind in 1900. Pathology of Coloboma of the Iris is the subject of a thesis by **Wimmer.**

CORECTOPIA.—In **Larsson's** case, in a woman aged 47, the left iris of light yellowish brown color showed in its temporal portion a large oval vertical opening, apparently the pupil. Its

lower part extended to the limbus, where the iris was totally missing. Above this a small seam of iris formed the temporal border of the opening. The nasal portion of the iris, a crescent, was the best preserved part, forming, as it seemed, the area of the sphincter, because it contracted upon light. It showed a slight eversion of the pigment layer. The remaining iris consisted of narrow strands which radiated from wider insertions to the above mentioned nasal crescent. The strands were composed partly of the dark brown pigment layer. Between the strands were complete defects thru which the illuminated fundus could be clearly seen. At the upper portion of the iris was a small coloboma. Excavation of optic disc, tension 70. V = fingers at 2 m. The patient stated that she had not previously noticed such a change of her eye as the present one.

A review of the literature shows a great diversity in the explanation of the affections, similar to Larsson's case, but in all a more or less marked corectopia existed. Larsson assumes for his case a congenital anomaly, viz., a corectopia or an atypical coloboma with corectopia. In consequence of traction by the relatively well preserved sphincter, or by shrinking of the sphincter, interrupted in its continuity, an atrophy of the iris took place, with subsequent defects. The perhaps congenitally weakened iris was torn in the portion opposite to the corectopia which was most exposed to mechanical influences.

This mode of development would be analogous to the congenital defects of the iris. Why, in a number of cases, it occurred so late in life may have been due to increased tension, since glaucoma may at any early stage cause atrophy of the iris. The pigment layer could be seen in a lower plane and its defects, in their direction and appearance, did not completely correspond with those of the anterior layer of the iris from which it was separated by the hypertension of the iris, but on account of its content of elastic and stronger dilatator fibers resisted. Larsson sees in this a further support of the mechanical etiology.

Niederegger describes a congenital ectopia of the slit shaped right pupil of a man aged 31, and an ectopia of the left pupil, the slit shape of which ordinarily was slight, but became pronounced upon strong illumination. So far, only 14 such cases have been reported. Probably the extending of the iris in the surface of the two opposite places was prevented by the traction of abnormal strands from the lateral pupillary margin into the adjoining sinus, and the slit shaped pupil resulted.

Lutz reports two cases of physiologic anisocoria, the one pupil being 0.5 mm. wider than the other. Both patients were healthy, with normal eyes and normal pupil reactions. He seeks an explanation for such unilateral inequalities in heredity, and discusses the effect of dominant recessive characters in this and numerous other unilateral anomalies.

Polycoria.—True polycoria is one of the most rare malformations of the iris. **Bergmeister** observed in an otherwise healthy soldier triplocoria. The right eye had an almost central transversely oval main pupil which reacted very slightly. The largest diameter was 3 mm. outward, downward and inward; upward were two smaller pupils in the midst of the ciliary part without interruption of the iris circle. All three reacted to atropin and pilocarpin and gave a red reflex of the normal fundus. In mydriasis remnants of pupillary membrane were perceived in the central and lower pupil. No polyopia. The reactions proved that each pupil had its own sphincter, which was not present in most cases of polycoria. Undoubtedly an embryologic connection exists with the persistent pupillary membrane. So far there are no anatomic findings, but Bergmeister assumes indentations of the margin of the ocular cup in the third and fourth month for the occurence of true polycoria.

Bergmeister also observed in a Russian war prisoner multiple congenital iridodialysis, two gaps outward downward; and two gaps inward upward.

The central pupil was not round. Bergmeister emphasizes the heredity described in three cases.

In **Botteri's** observation the upper third of the light gray iris of the right eye of an intensely dolichocephalic, a man with slight intelligence, aged 26, with brown hair and a small zone at the lower periphery of the iris was distinctly brown, below this a black nevus. The pupil was missing at the regular place, but in the lower temporal third of the light gray tissue, which looked like atrophic but thickened iris there were two oval horizontal openings, the pupils of this eye, separated by a border 1.5 mm. wide. The noncentral pupil had a normal pigment seam, the temporal pupil showed ectropion of the pigment layer on the anterior capsule of the lens, with dustlike diffusely scattered pigment dots. Both pupils, especially the more central, reacted promptly to light and accommodation, their vertical diameters becoming smaller, the horizontal diameters remaining almost uninfluenced. With the use of atropin both pupils became nearly round. Right vision with $+2.50=6/6$.

The left iris presented a similar condition of two colors, but three pupils in form of horizontal fissures; a lower nasal which was the shortest, a more central, and a higher temporal, the largest. All were lined by a pigment margin and separated by iris parenchyma. Atropin dilated all the pupils to pear shape. Vision $+ 1.= 6/6$. The ophthalmometer showed astigmatism R. $70° > 160°$; L. $15° > 105°$. Fundi without pathologic changes. This case differs from the usual forms of polycoria, which consists in several, generally radial fissures, besides the round pupil at the normal site.

In **Carsten's** case of congenital hole formation of the iris the pupil was displaced downward and to the nasal side. The temporal portion presented a large defect lined by a brown zone and very fine gray threads were bridged over it. The iris was tremulous and there was partial cataract of the dislocated lens.

Stähli accidentally observed in about 30 cases, as a relatively rare variety of the pupillary seam, excrescences in the shape of fingers, verrucae, always symmetric in both eyes at the upper pupillary margin. They are a congenital atrophy of the retinal pigment layer of the iris, i. e., of ectodermal origin, similar to or partly identical with the very common appendages of the pupillary margin in horses and other herbivorous animals, and possibly an atavism. **Hirschberg** proves in a bibliography of ten references that Stähli's observation is neither new nor unusual.

Physiology, Nutrition.—According to **Hamburger**, the metabolism of the iris is more active than that of the ciliary processes, which are built on the type of corpora cavernosa and have the static function to withhold the accommodative pressure of the lens from the iris and cornea. Thus they are lacking in the fish in which the accommodation occurs by a backward movement of the lens. He does not deny a slight secretory activity of the ciliary processes for the scanty nutrition of the lens and vitreous. Anterior and posterior chambers are separated by an absolutely water-tight valvular closure, of which we do not know how often or how rarely it is broken. The assumption of a filtration from the anterior chamber into the canal of Schlemm has become impossible. For maintaining the status quo of the eye, a healthy iris as a suction sponge with its pores directly immersed in the aqueous, is much more important than the canal of Schlemm.

Hagen repeated his former experiments on a physiologically normal eye destined for enucleation on account of a small tumor at the posterior pole, which corroborated his former conclusions. He emptied the aqueous five times and thus withdrew more than 1 ccm. of the bulbar content without finding the least increase of albumin or the least increase of coagulation. The immediate regeneration of the withdrawn aqueous is furnished thru transudation of vitreous thru the zonula. The continuous oozing of vitreous fluid thru a corneal fistula produced a serous detachment of the choroid, the suprachoroidal space was filled by

transudation from the choroidal vessels.

The different irritations cause, in the eye of the rabbit, an early but very transient secretion of the ciliary body, in the human eye a slow, less intense, but lasting secretion. It is easily conceivable that the secretion of the intraocular fluid which in man is so different from blood serum, must take place more slowly than the transudation of a fluid similar to serum, in the rabbit. If it is confirmed that the secretion of the human ciliary body in the state ot irritation is a normal intraocular fluid, free from albumin, it is probable that it is only an increased physiologic secretion. Then the experiment does not contradict that also in the intact eye the ciliary body secretes fluid. **Von Hippel** saw the vesicles of the ciliary processes described by Greeff, in several cases after opening the anterior chamber for iridectomy.

Bonnefon gives a preliminary report of his experiments to determine the relation of the choroidal and ciliary circulation to the secretion of the aqueous humor and the tension of the eyeball. The ciliary vascular tension was found to be fairly constant, but the choroidal vascular tension varied. The socalled choroidal muscle controls the vascular tonus of the choroid, and plays a part in the control of ocular tension. The aqueous emanates from the ciliary vessels. A more complete report of extended experiments will be published later.

Löwenstein examined refractometrically the regenerated aqueous of human eyes with normal anterior segment, which were blind from atrophy of the optic nerve, and found it entirely different from that in our usual experimental animals, in accordance with Hagen. It is probable that the vitreous fluid covers the defect of the aqueous, but we do not know how the resultant defect of vitreous is supplanted. His refractometric examination of aqueous in eyes with increased tension from recent iridocyclitis, yielded an increase of refraction. Clinical experiments show the good results of puncture, which from experiments on animals were unexplainable until our knowledge of the lack of albumin of the regenerated human aqueous cleared it. **Leplat** discussed the arterial pressure of vessels of the iris and the influence of various collyria upon it.

IRIS MOVEMENTS.—**Mazzei** injected 0.4 ccm. of extract of spermin into the anterior chamber of dogs, and observed after 6 minutes miosis. Subsequent injection of atropin 1 per cent produced mydriasis after 7 minutes. In recently enucleated eyes of frogs spermin acted promptly as a slight miotic, adrenalin ovarian endohypophysin, endothyroidin as mydriatics, the rapidity decreasing from adrenalin down in the above order to endothyroidin. When mixed the mydriatic hormon acted less promptly than the miotic spermin but its miotic reaction rarely remained predominant.

In **Magitot's** extended article, the author discusses motility of the iris under the following heads:

Vascular Theory. This explains the contraction and dilatation of the pupil upon the basis of a dilatation and contraction respectively of the iridal vessels. Altho there are undoubtedly slight movements due to these causes and altho an inflammation of the iris with an overfilling of the vessels will cause a contraction of the pupil, the theory cannot explain the normal movements.

Vasomotor Influences. The existence of vasomotor influences upon the iris has been proven. But from the experiments of certain, quoted, authors it is possible to conclude that this is not the cause of the pupillary movements.

Inhibition Theory. This explains the dilatation of the pupil on the basis of inhibition of the action of the sphincter, permitting the action of the normal elasticity of the iridal tissue. This factor certainly exists, but it is insufficient to explain, by itself, the pupillary dilatation. It is accompanied by a contraction of an antagonistic system.

Iridal Musculature and the Two Antagonistic Muscles. The existence of a dilatator pupillae is generally accepted today. However, there are arguments against it, so the author gives a review

of the arguments pro and con. His conclusions are:

(1) There is a dilatator force.

(2) It is more powerful than the contracting force.

(3) It is less affected by slight stimuli.

(4) It can cause a local action in the iris, while that of the sphincter is more general.

(5) It is governed by nervous influences from the cervical sympathetic via the long ciliary nerves.

(6) This dilatator force is present thruout the whole iris.

Is the socalled dilatator muscle, which is so delicate that it might rather be called a dilatator layer or myoid membrane, sufficient to cause dilatation of the pupil?

A. Arguments for:

(1) Staining by picro-fuchsin.

(2) The layer seems proportionate to the thickness of the sphincter.

(3) It is composed of epithelium. The sphincter and ciliary muscles are likewise epithelial.

(4) A stronger current is needed for dilatation than for contraction.

(5) The physiologic dilatation has a very localized action.

(6) Certain nocturnal birds of prey have a striated muscular layer in the region occupied by the myoid layer of the mammalia.

B. Arguments against:

(1) A decided difference in the proportions of the sphincter and dilatator in spite of the preponderance of the dilatator force.

(2) Henle's membrane nowhere shows waving or concentric folds when the pupil is dilated.

(3) It ceases at the base of the iris. There is a space between the root of the iris and the ciliary processes. Nevertheless, excitation of the sympathetic will cause an increase in the dilatation of a pupil already under the influence of atropin.

(4) The layer does not appear until the 7-9 month of pregnancy.

Magitot has shown that in prematurely born children, photomotor reflexes exist as early as the 6th month, and are well developed by the 7th month.

(5) Compared to the sphincter, Henle's membrane has rather the character of intradermal muscles or the contractile cells of the glands. Its innervation should be of the same order, whereas, it is possible to dilate an isolated area of the pupil, but not to contract.

The preponderance of the arguments would seem to be against, but there seems to be no other muscle, capable of taking its place as a dilatator. The recent microscopic studies of the living eye would indicate that there are contractile cells in the stroma. It would seem that one of two positions must be taken; either the stroma is contractile, which would explain the power of the dilatation, or it is not contractile, in which case it is necessary to find another structure which will augment or replace the myeloid membrane of Henle.

Uveitis. Etiology and Pathogenesis.—Iritis due to *focal infection* from pyorrhea was observed by **Walker, Patterson, Boyd,** from the tonsils by **Crossley,** from appendicitis by **McGuire,** disseminated choroido-retinitis from sepsis from an old wound on the foot which was very tardy in healing and tender, by **Batten,** uveitis from various toxemias by **Wilmer,** and recurrent iritis in dermatitis exfoliativa by **Gifford.** McGuire recorded a very acute type of uveitis in a girl, aged 16, whose general and personal history and the usual diagnostic tests gave no clue whatever as to its origin. The eye showed iritis with marked ciliary congestion, numerous deposits on Descemet's membrane, densely infiltrated vitreous, high tension, vision reduced to light perception. After two months of entirely ineffectual treatment the patient said that on the night her vision became impaired she had suffered from rather a severe attack of pain in the right iliac region, that recurred several times during two months. A diagnosis of chronic appendicitis was made. At the opera-

tion the appendix was filled with pus and almost ready to perforate. A few days later she noticed a marked improvement in her vision. In six weeks vision was normal and all evidences of inflammation had disappeared, and when examined 18 months later there had been no recurrence during that period, and the eyeground was entirely free from secondary changes.

Boyd's case with recurrent iritis promptly recovered from a more recent attack after extraction of all his teeth. But another attack followed after there had been some sort of inflammatory rheumatism. In the discussion Black suggested to have the patient's prostate milked to ascertain whether it harbored an infection. In the discussion on iritis by **Halliday**, Barrett and Gibson considered a third of the cases were syphilitic in origin, and that about one-half the cases corresponded to a clinical type called "rheumatic." There was no evidence that these cases had anything to do with rheumatism, but they were powerfully influenced by salicylates. It was thought desirable to retain the term "rheumatoid iritis" because every one knew what it meant. Of the remaining cases a number might be due to septic foci, pyorrhea, etc.; but Barrett confessed to a skeptical attitude, as tens of thousands had septic foci and did not get iritis. **Decherd** has written on focal infection from the teeth to the eye.

In reporting a clinical history as an illustration, **Shannon** says that there are many cases of iritis which seem to date from attacks of pain in the joints or muscles—call it rheumatism, autointoxication or what you will—and which are exaggerated in cold damp weather; and it would appear therefore, as if we might find it advisable to retain the name "rheumatic iritis" at least a little longer. **Folman** writes on the etiology of rheumatic iritis and **Roper** gives dampness as a cause of iritis.

Gilbert admits the term rheumatic iritis only for cases in the course of true chronic articular rheumatism which develops from acute rheumatic polyarthritis, and of the more rare primary chronic arthritis deformans, rheumatoid arthritis (Garrod's), of which he reports 2 cases. The iritis set in after the rheumatoid arthritis had existed for years and took the benign course of most true rheumatic inflammations of the iris. Finally there are subacute and chronic cases of articular rheumatism which can be attributed to tuberculosis. Gilbert agrees with Krückmann who contrasts the rheumatic and gonorrhoic superficial iritis, with that of the deeper layers, chiefly represented by tuberculosis and lues. He mentions as characteristic of the larger group of metastatic iritis, under which he classifies rheumatic iritis, multiple fine adhesions of the pigment layer, which arise after tearing of other synechiae in maximal or almost maximal mydriasis, and can be easily detached, but are apt to relapse repeatedly until they finally disappear by proper treatment. He calls them futile posterior synechiae in mydriasis. With Wessely he attributes again more importance to colds as factors for metastases of any latent morbid agents in the body. The etiology of only too many cases remains not clear, altho one is convinced of their metastatic nature. Gilbert therefore proposes to comprise under a large group all iritis in acute infectious diseases cryptogenetic infections, gonorrhea and rheumatism, as diffuse metastatic iritis, antithetic to focal metastatic iritis, the chief representations of which are lues and tuberculosis.

Gilbert mentions the peculiar fact that in a case of fatal streptococcus sepsis of Schüssele a mild not purulent iritis was observed, corresponding to the more general symptoms of sepsis, with no inclination to metastatic inflammations. The opposite takes place in staphylococcus sepsis. Thus Gilbert found in a case of relapsing iridocyclitis with universal pyrodermia staphylococci in the pustules, and classed the so far clinical picture under a mild cryptogenetic staphylococcus sepsis. From this connection with staphylococcus sepsis Gilbert recommends in cases of relapsing iritis, even

if there are no furuncles or pustulous exanthemata, a diagnostic injection of opsonogen (250 millions 12 ccm.), and if possible the usual opsonogen treatment for preventing relapses. He has had no experience with streptococcus serum, but thinks it is indicated in proper cases, as local therapy is of no avail.

Passow described a bilateral metastatic ophthalmia in a case of carcinoma of the uterus from thrombophlebitis of the inferior vena cava. Death. Histologic examination of the eyeballs reminded him of Axenfeld's cryptogenetic pyemia in which without apparent portal for microorganisms any diseased mucous membrane is of importance. The author sees the explanation of the exclusive affection of the eyes in the region supplied by the carotids in the assumption that occasionally some infectious material was loosened from the infected thrombus with a single flooding of the blood with streptococci, just so much, that the organs excepting the eyes could resist the infection. **Pockley** has written on iritis. **Wallace** reported an iridocyclitis of unknown origin in which the spots on Descemet's membrane showed a fairly regular triangular arrangement, but with the apex downward. **Jacqueau** and **Lemoine** report a case of acute bilateral iridocyclitis associated with tenonitis in a man 58 years of age; and **Terlinck** reports simultaneous metastatic choroiditis and tenonitis following pneumonia.

Dellmann gives the first description of an ophthalmoscopically and anatomically examined metastatic ophthalmia caused by streptococcus viridans, which was found intravenous in the blood. The right eye of a man aged 27, had become blind four months before from endocarditis lenta, and showed four weeks before death atrophy of the optic nerve with indistinct borders. The histologic alterations were limited to the retina and optic nerve, excepting slight involvement of the ciliary body and choroid, probably embolisms, certainly not a chemotactic effect from the retina. The left eye presented the clinical picture of papillitis with numerous peripapillary hemorrhages and some white foci with and without surrounding blood extravasations, and microscopically accumulations of lymphocytes, forming the white foci chiefly in the layer of nerve fibers around the capillaries. The disc was edematous. The choroid showed small infiltrations around the capillaries probably due to embolisms. Their separation from the retinal foci proved that they were not produced by chemotactic action from the retina.

Dellmann's classification of the metastatic processes in the eye based on the more carefully examined cases elucidates that septic retinitis and purulent metastatic ophthalmia are not to be separated, that their differences are only gradual, and that one may evolve from the other. Both are caused by colonization of germs in the eye and septic retinitis is not exclusively elicited by toxins circulating in the blood. The gravity of the metastatic changes goes parallel with the virulence and quantity of the morbid agents. This conception agrees very well with the observation that in the same eye degenerative and inflammatory phenomena may occur simultaneously, and that clinically septic retinitis can be ascertained in one eye, and purulent ophthalmia in the other.

Cousin saw a case of metastatic ophthalmia of the right eye, which was secondary to streptococcic septicemia. The condition improved following the administration of antistreptococcic serum.

The empyematous pleural cavity of a patient was filled with bismuth paste for examination with Roentgen rays. This was suddenly followed by dyspnea and loss of consciousness, and on awakening by total blindness. **Seefelder** found no ophthalmoscopic changes. Vision returned after 5 days. After 4 weeks changes which suggested damage to the pigment epithelium, retina and choroid: Glaring white, yellowish or yellowish-red well defined, roundish foci of the uniform width of the central vein, in both eyes

symmetric, laterally of the disc. No pigment proliferation. They remained unchanged during 4 weeks with corresponding lack of function, and reminded one of colloid bodies (drusen) of the vitreous lamella. Analogous alterations after experimental section of the posterior ciliary artery and experimental retinochoroidal embolisms led Seefelder to the conclusion that the affection was due to disturbances of circulation in the choroid from embolisms of the smallest choroidal vessels. The slight changes are explained by the assumption that only very minute particles of the injected mass entered the circulation. The pigment epithelium, impenetrable by light, prevented visible ophthalmoscopic signs in the first few days. As the opthalmoscopic findings did not sufficiently explain the deterioration of vision at that time, the author attributes this to cerebral disturbances of circulation probably in the visual center.

A man, aged 23, observed by **Wilmer,** was given a lipotyphoid injection upon his discharge from service in the navy. He gave a history of a mastoiditis of the right side 3 years before, removal of the tonsils, and extraction of bad teeth and scraping of bone 14 months before. At the time of inoculation he had a chronic bilateral maxillary sinuitis with an acute exacerbation. Immediately after the inoculation there was a general reaction. The right eye became badly inflamed. As the inflammation disappeared, the patient noticed a central blind spot. Shortly afterwards he began to have trouble with left eye, which showed 2 small peripheral spots of chorioretinitis. The right eye presented a central spot of chorioretinitis surrounded by small hemorrhages.

Why this immunization is followed by eye lesions in some cases and not in others might be explained by the varying age of the solution, the general lowered resistance of the individual and the sensitization of the eye tissues by some preexisting toxemia. In this case the long-standing sinuitis furnished the necessary sensitizing medium.

Wilmer has seen a few very severe cases of plastic uveitis following large doses of thyroid extract self administered for the reduction of flesh. In every case the general nutrition suffered severely with the rapid reduction in weight.

Fuchs gives the clinical and anatomic description of intraocular actinomycosis in a poorly nourished woman with arteriosclerosis and myodegeneration of the heart. Six weeks after a successful cataract operation, an insidious inflammation developed in the eye, which at first yielded to treatment, but soon relapsed with intense pain. When Fuchs saw her 2 years later, the eye was red and showed a flat prominence from the limbus, 1 cm. backward, which looked like an episcleritic swelling. Iris hyperemic, hypopyon, occlusion of pupil by a membrane. The nodule contained actinomyces, which led to necrosis and suppuration of the sclera and ciliary body. Around the necrotic focus, a belt of epithelial cells and later granulation tissue had formed. Apparently, the actinomyces, which exceptionally occurs in the lacrimal canaliculi, conjunctiva and lid borders, was introduced into the open wound during the cataract operation thru instruments, margin of upper lid or lacrimal secretion. Peculiar was the predilection of the fungus for the fibrous tissue of the sclera, which otherwise is rarely invaded by pathogenic organisms.

In **Koehne's** case of retinochoroiditis (Jensen) in a girl aged 24, who had influenza 2 months previously, the changes consisted of a dense white exudate covering the optic disc and a prominent oval white focus extending from the disc downward to the nasal side (in the inverted image) for 1.50 disc diameters, with a few pigment dots and hemorrhages in its surroundings. The visual field showed a defect in form of a sector with the apex in the blind spot. The affection gradually receded. Tuberculosis and lues which are of importance in the etiology were excluded. The differential diagnosis from primary optic neuritis is determining for prognosis and therapy.

There is no special etiology for this disease.

Boeminghaus observed, 3 weeks after influenza with bronchopneumonia, an insidious inflammation of the left eye with sudden acute exacerbation which required enucleation. The eye showed purulent inflammation of the nasal side of the ciliary body, due to metastasis thru the ciliary vessels, not thru choroidal and retinal vessels. The secretions contained clusters of staphylococci.

Löwenstein noted 17 days after influenza in a poorly nourished man, aged 36, who 18 years before had lues, (Wassermann positive) exophthalmus of left eye, motility in all directions almost abolished, chemosis, cornea dull, aqueous opaque, no hypopyon, iris greenish and swollen, circular yellowish gray exudate in pupil, lowered tension, no red ophthalmoscopic reflex, candle at 2 m. Hot applications, aspirin, mercurial inunctions, 10 ccm. milk intramuscular, 39.4°, no reaction on the eye. After a week chemosis and pain increased, so that exenteration of the eyeball was performed. Vitreous showed yellowish green, and the ciliary body lardaceous infiltration. The temperature became normal. Smooth recovery. The bacteriologic examination revealed diplostreptococci, which most likely was the morbid agent of the influenza. **Kerbrat** reports uveitis with grippe.

A woman, aged 73, came to **Meller** with the symptoms of a past herpes zoster, an epithelial defect of the cornea, no infiltration, ciliary injection, hypopyon, zoster necrosis of the iris with subsequent reactive inflammation, high tension. The intensive neuralgic pain was relieved only by deep radiation of the ganglion. The affection of the iris was long protracted, the height of the hypopyon fluctuated, and finally a thick membrane formed in the pupil. As light perception decreased with doubtful projection, the eye was removed. Microscopically the pus of the anterior chamber contained hemorrhages. The sclera presented scleritis thinned places, and cellular infiltrations of the ciliary nerves, which already showed severe inflammation behind the eyeball. They carried the inflammation in their transit thru the sclera to the choroid and suprachoroid. In the choroid were nodular cells, with the character of sympathetic inflammation. This was of interest, as cases of sympathetic ophthalmia after herpes zoster have been described. The lower half of the iris was necrotic, the ciliary body was almost free of changes.

Etiologically 2 groups of cases are distinguished. In one inflammation of the spinal or semilunar ganglion was found, e. g. by Lauber who detected severe inflammatory changes and hemorrhages in the ganglion from which the first branch arises. The inflammation proceeded along the nerves, gradually subsiding, leaving the nerves in the eye free. In others, particularly in the present case, was a marked neuritis, but nothing could be said on the condition of the ganglion.

Meller mentions the well known affections of the cornea, which by secondary infection may change the aspect and lead to secondary iritis.

Rubio calls attention to the etiologic importance of the malarial germ as the possible cause of many cases of iridochoroiditis that were treated by mercury without benefit.

Weekers described a case ot iridocyclitis with facial hemiatrophy. **Veach** briefly reviewed the varied etiology of iritis and reported his experiments on rabbits, in which he produced iritis by injecting into the base of the iris 0.05 to 0.10 cc. of a suspension of staphylococcus aureus, streptococcus hemolyticus and streptococcus viridans.

Purtscher observed a purulent infiltration with hypopyon of a large cystoid scar at the lower sclerocorneal junction of the left eye of a man, aged 63, remaining after an optic iridectomy for zonular cataract performed 50 years previously. No bacteriologic examination was made, but the beneficial action of optochin hydrochlorid 1% rendered it probable that the infection was caused by pneumococci.

Mooney showed a case of central choroiditis in an exsoldier, which he thought was due to concussion from heavy gun fire.

Weve reported 3 cases of iridocyclitis with epidemic parotitis, in which tuberculosis and lues were excluded by negative von Pirquet and Wassermann reactions. He sees no reason to establish a new clinical picture, but considers the iridocyclitis as part of the parotitis, a connection which is early overlooked, as the iridocyclitis sometimes precedes the parotitis for weeks. Therapeutically he had success with radium treatment of the iridocyclitis which occurred in nodular form.

Mohr reported a man, aged 34, who had a parotitis 12 years previously, presented simultaneously with a severe iridocyclitis, and a soft swelling of both parotid glands. Wassermann was positive. Under antisyphilitic treatment the iridocyclitis subsided. Hence Mohr considers lues as the cause of the uveo-parotid disease. Most cases of Heerford's complex were observed at a time before the Wassermann test had been introduced, so that probably lues would have been ascertained more frequently.

Müller reports iridocyclitis in parotitis epidemica with swelling of salivary glands in a boy, aged 15, affected with tuberculosis of the bronchial glands, 1½ years after a severe bilateral tubercular iritis. Suddenly a relapse of iritis and swelling of the parotid and lymphatic glands of the left side of the face and neck occurred without fever, but with paresis of all branches of the left facial nerve. As there was no doubt of the tuberculous etiology, the differential diagnosis of parotitis epidemica was out of the question. Müller contends that the original focus in the bronchial glands gave rise to the relapse of iritis and the affection of the glands, and that the eye disease did not directly cause the swelling of the glands. As this was on the side of the less affected eye, it seemed possible that the parotid and submental glands intercepted the nocuous element. The paresis of the facial nerve apparently was due to pressure from the swollen parotid, perhaps also to the infectious toxic process. The swelling of the parotid reacted well to Roentgen rays, but not the lymphatic glands.

After a review of the literature on iritis, and iridocyclitis in epidemic parotitis, **Rieth** relates the clinical history of a formerly perfectly healthy girl, aged 12½ years, who, during an epidemic after an acute onset of a swelling of both parotid glands that took a protracted course, showed redness of both eyes. Two months after the beginning of the still marked swelling, Rieth ascertained synechia, opacities of the vitreous and optic neuritis, followed after 2 weeks by bilateral paralysis of the facial nerve. Examination with Roentgen rays revealed extensive swelling of the bronchial glands. Eight months after the onset tubercular nodules were noticed on the left iris, and 2 months later on the right iris. Finally considerable improvement. The facial paralysis was ascribed to toxic infectious damage or a primary meningitis, not to the effect of pressure. Therefore in similar cases with involvement of the optic nerve limbus puncture ought not to be omitted. Reith concludes that iridocyclitis as specific partial phenomenon of epidemic parotitis cannot safely be excluded, but is by no means rendered probable. The cases observed with all modern methods, including his case, speak for other processes, especially tuberculous uveitis. In parotitis of other origin, evoked by chronic diseases, as lues and tuberculosis, system affections of the lymphatic apparatus and disorders of endocrine organs, the complex of symptoms, iridocyclitis and swelling of the parotid is to be attributed to the same cause, (lues or tuberculosis) or a cooperation of several causes.

According to investigations of **Schieck** in serous iritis, the seat of the disease is the pupillary portion of the iris, as shown by the following observation, which may be made in every

case of florid serous iritis. With slight coloring injection and normal appearance of the iris, between and before, or behind the ridges of the pigment seam at the pupillary margin minute, glassy, greyish white beads of exudation ooze like frog spawn, chiefly in the pigment layer. Accumulations of this material are precipitated on Descemet's membrane and anterior capsule and render the aqueous turbulent. It may obstruct the efferent passages of the aqueous with subsequent hypertension, so that the term obturating iritis is appropriate.

Weisenberg observed in an otherwise healthy girl of 17 years an acute chorioretinitis with massive exudations in the deeper layers of the retina, and hemorrhages under the posterior portion of the choroid, of unknown etiology. Ophthalmoscopically there were an extensive white focus, on which the vessels coursed, numerous hemorrhages, and yellow color of the macula. The clinical aspect was that of exudation or hemorrhagic external retinitis described by Coats, von Hippel, Axenfeld and others, but differed from it by its acute course.

Bane presented a man, aged 31, who complained of loss of vision in the upper portion of the left visual field. To this corresponded closely an area of choroiditis in the macular region and 2 small hemorrhages between the optic disc and the macula.

Fuchs gives a detailed anatomic description of 7 cases of chronic endogenous iridochoroiditis. They occurred in persons of middle or higher age, who clinically showed for years a very chronic endogenous iritis with slight external inflammatory symptoms, no plastic exudations, only posterior synechiae and thin pupillary membrane, which prevented, in all but one, ophthalmoscopic examination. According to the anatomic changes, this would have revealed disseminated choroiditis. In only one syphilitic etiology could be proven. Fuchs concludes, that the inflammation started from the choroidal vessels, and by toxic action led to degeneration of the retina and inflammation of the iris, leaving the ciliary body free. The ciliary body and posterior surface of the iris were covered with a double epithelium and thus more protected from the toxins acting from the vitreous and aqueous. The anatomic changes were characterized, in the group of 6 cases, by the regularly occurring large elliptical (12 longest diameter) granulated cells, distributed like mast cells in the tissue of the iris, sparse in the ciliary body, and exudate in the subchoroidal space. The granules lay very dense and stained intensely with eosin. Their origin is not known. In 5 cases were also hyalin globules.

In discussing the treatment of chronic iridocyclitis and its complications, **Darier** remarks that first the cases must be carefully studied to determine the etiology. This is often difficult because a negative Wassermann does not necessarily exclude syphilis, and complement fixation for tuberculosis and gonorrhea are not yet reliable tests. When the course cannot be determined by careful investigation, therapeutic measures must be employed empirically. The author discusses the current methods of treating chronic iridocyclitis and reports cases.

Ginsberg gives the histologic description of an enucleated eyeball of a woman, aged over 50, affected with syphilitic iridocyclitis. In the organized exudation, without specific products, he found purulent colliquation and partial necrosis of the connective tissue; and in the ciliary body and iris typical lymph follicles with well developed germ center so far not described. Contents of the blood vessels were normal.

The question as to the etiology of such follicle formations is intimately connected with the genesis of heterotopic lymphatic proliferations. It has been held that lymph follicles can form only in adenoid tissue. Ribbert, however, maintains that the foci of small-celled lymphocytic infiltrations evolve by the growth of normally present, but very little developed, foci of lymphoid substance, but may also arise in new-formed connective tissue. In the ciliary body traces of adenoid tissue have

never been proven. If the small-celled foci of infiltration in chronic inflammations correspond to lymph nodules, the occurrence of germ centers in them does not seem strange. Ginsberg takes his case as a support of the view of Ribbert.

Herrenschwand observed in the iris of a woman aged 42, a papule at the same place which seven weeks previously had been the seat of two typical tubercles, that had disappeared on injections of partial antigens according to the method of Deycke-Much. Under antisyphilitic treatment the papule subsided leaving a sharply circumscribed atrophy of iris tissue. When the patient returned five months later, this part of the iris presented again typical tubercles, a classic illustration of *locus minoris resistentiae.*

Patterson described a granuloma in the upper part of the iris, occurring 48 hours after an acute exacerbation of iritis in a man, aged 29, who had a chancre 10 months previously. The nodule, of a reddish brown color, daily increased in size, and was traversed by 3 minute vertical blood vessels. But the time of its appearance and the rate of its growth were against the diagnosis of gumma. The patient had pyorrhea and a focal infection was therefore considered. In discussion Crisp related a similar case, in which the granuloma disappeared after removal of seven badly abscessed teeth.

Two cases of disseminated choroiditis were reported by **Weeks.** Both cases occurred in males, one aged 26, and the other 29 years. Tuberculosis and syphilis were excluded. Both improved, following an operation for the drainage of infected nasal sinuses. The author concludes that when focal infection in other parts of the body, syphilis and tuberculosis have been excluded in cases of choroidal exudative processes, the nasal accessory sinuses should be carefully investigated as a cause.

Verhoeff reported the history of a man, aged 28, who was treated with neosalvarsan and mercury for a chancre of the left tonsil, and improved. After 2 months deterioration of vision and pain of left eye from iritis, opacities of the vitreous and finally detachment of the retina. Wassermann negative. In spite of energetic antisyphilitic treatment, complete blindness. Enucleation. Granuloma was found near the optic disc in the inner retinal layers while secondary syphilides of skin and mucous membrane developed, which were cured after 4 months treatment.

Magruder reported a case of iridocyclitis in a negress 41 years of age. The other eye was soft and blind from an injury 7 years before. There was rapid improvement after the removal of the blind eye and after the administration of K. I. and mercury.

Fernandez discussed the various clinical forms of syphilitic iritis; and **Yoshida** examined a congenitally syphilitic child, in whom the surface of the iris was covered with small white spots. The child died of pneumonia. Anatomically the whole parenchyma of the iris was infiltrated with cells, especially next to the vessels which did not seem to be affected. To the white spots corresponded small foci of cells at the crypts. The posterior surface exhibited at the places of synechiae detachment of the pigment epithelium layer and its cavities filled with cells. Ciliary body and processes showed no vascular changes and were only lightly infiltrated with cells, choroid not altered. **Mas Soewarno** discussed depigmentation in lues, under anomalies of pigmentation, and **Mohr** iridocyclitis with swelling of the parotid in lues, under etiology.

Tuberculosis. Diagnosis.—For the diagnosis of ocular tuberculosis, **Hessberg** and **Wilmer** recommend in adults the subcutaneous injection of old tuberculin as the only reliable test. In about 50% of the cases of iritis, a local reaction can be perceived by frequent inspection of the diseased eye in the critical days, viz., greater pericorneal hyperemia, infiltration of the diseased area, eruption of small nodules in conjunctiva, cornea, or iris, phlyctenulae, deposits on Descemet's membrane, opacities of the vitreous, etc. But even

if this is lacking, positive general reaction renders it probable that the eye affection in question is tuberculous, if the clinical picture suggests it. Exact physical examinations and consultations with internists must be the basis for special therapy.

Behr observed a boy, aged 4½, who presented the aspect of tubercular iridochoroiditis with formation of nodules in the iris. The eye was amaurotic and was enucleated in order to remove the supposed infectious focus. The microscopic examination revealed glioma of the retina and the apparently typical changes of the iris caused by metastatic gliomatous proliferations.

For facilitating the bacteriologic diagnosis of tuberculosis, **Guillery** employed the accumulation method after treating the tissues with antiformin, which yielded such good results in the examination of sputum. The eyeballs were fixated in formalin or sublimat, and after washing and treatment with iodin-alcohol hardened in alcohol up to 96%. Then the eyeball was sagittally cut in half. The uvea of one half was cut into smaller pieces and brought in 15% antiformin solution in the incubator. After about 5 hours everything was dissolved. The centrifugate was transferred to a slide, fixed on a flame, and stained, partly according to Ziehl-Neelsen, partly to Much. The other half was used for histologic examination. Thus Guillery examined various tubercular organs of man and animals, and in almost all cases found without difficulty the bacilli, but not always in great numbers. He had the same positive results with the eyes of rabbits intravenously inoculated with tubercle bacilli. The eyes must not be treated with Mueller's fluid, which inhibits the staining. Guillery recommends his method also in uveitis of unknown origin.

Siegrist reported a case of chronic uveitis in a girl, 20 years of age, who had active pulmonary tuberculosis. He comments on the frequency of uveitis in tuberculous subjects.

Bogardus gives a general survey of ocular tuberculosis, methods of diagnosis and treatment employed at Bellevue Hospital, New York, with reports of 4 illustrative cases. **Holth** has written on tubercle of the iris, and **Kriedlova** on tuberculosis of the iris and ciliary body.

According to **Hessberg,** tuberculosis occupies the first place in the etiology of the diseases of the uvea, especially iritis. Its chief characteristics are the formation of small nodules in the iris tissue, frequently in the walls of the small arteries. They are only visible under strong loupes, and are so transient that they may disappear after a few hours. The tubercular foci have the character of weakened tuberculosis and may heal without or with scars. These defects of tissue occur, in which the dark pigment layer appears. By this macroscopic aspect the diagnosis of former tubercular iritis can be made after many years. Relapses with aggravation may occur. Phthisis and tuberculosis of the joint rarely predispose to diseases of the uvea, but more frequently affections of the lymphatic glands, especially of the mediastinum and mesenterium. While the acute cases show the usual symptoms of iritis, the chronic cases may cause only visual disturbances. On closer examination discoloration of the iris and deposits on Descemet's membrane, and later opacities of the vitreous are found.

More than 50% of iritis may be attributed to tuberculosis. Its course is insidious and leads to intense disturbances of nutrition of the eyeball. While ocular tuberculosis is frequently isolated without involvement of other organs, especially the lungs, Hessburg points out that choroiditis in miliary tuberculosis is always metastatic, according to Stock in 80% of all cases. The round yellowish spots without pigment scars, chiefly around the disc, occur shortly before death. Similar foci have, however, been observed in pneumonia and typhoid. The larger, solitary and conglobated tubercles, which

by further growth may involve the sclera, iris and ciliary body, and may, especially in children, be confounded with glioma, which they greatly resemble in the glaucomatous stage. As the eye can hardly be preserved, it is practically useless, for which reason enucleation is performed. An exact anatomic examination is absolutely necessary for the prognosis of the life of the patient.

According to an editorial in the *New York Medical Journal*, the solitary tubercle of the choroid varies in size and even projects more than 2 to 3 mm. above the surrounding surface. It is of a pale yellowish white, in which its borders are gradually lost, the unchanged choroid surrounding it. Inflammatory lesions of the globe and hypotonus are diagnostic signs of great value, but not sufficiently constant. Only by puncture of the tubercle, followed by guinea pig inoculation with the material removed can a positive diagnosis be made. It develops spontaneously in tuberculous subjects, more frequently between the ages of 2 and 20 years, usually with advanced lesions. Often it progresses with characters belonging to true intraocular neoplasms, such as detachment of the retina or glaucomatous accidents. The tuberculous masses give rise to iritis or iridocyclitis, and in malignant growths no other ocular lesion will be found. A very important point is the invasion and early perforation of the sclera without preceding glaucomatous phenomena, while during the evolution of intraocular growths perforation takes place after a rather long lapse of time, always preceded by a glaucomatous phase. A malignant neoplasm invades the entire globe, causing it to project outwardly. Spontaneous recovery from solitary tubercle rarely has been known to occur, but usually vision is quickly lost, especially in children. A primary tubercle of the choroid appears to progress more rapidly than when it develops in a tuberculous subject. Generalization of the process usually takes place after perforation.

Jackson describes a case of chronic tuberculosis of the choroid in a girl, aged 21, observed for 8 years. The first symptom was impairment of vision (the lesion being macular), the ophthalmoscope showing nothing. In a few days a faint haze of light gray color, without definite boundaries appeared, which became lighter and more saturated with gray until it reached its maximum in less than 2 weeks. Then it became darker and varied toward a brownish gray. After 3 weeks it showed evidences of pigmentation, at first diffuse, then massing in many discrete spots, gradually shifting into marked brown or almost black patches, while the spaces between them became yellowish white and pure white. The edge became sharp and pigment bordered as in choroidal atrophy. The pigment showed a disposition to arrange itself in rings or ovals. The final ophthalmoscopic picture was conforming closely to that of an area of choroidal atrophy, devoid of choroidal vessels, few retinal vessels passing over it. Probably the yellowish rounded spots surrounded by nearly normal fundus of acute choroidal tubercle arise in a period of greatly lowered body resistance to tubercular invasion. With better resistance, the tubercle is hidden by a cloud of retinal exudate, until, as the process subsides, it is destroyed. Under the latter condition in the choroid it probably never reaches the stage of a central avascular cheesey mass. During early stages the general appearance of the choroid was rather dark, red and patchy, as it may appear in cases of marked eyestrain. Possibly choroidal congestion, thus indicated, may be the basis of increased intraocular tension, which, in Jackson's experience, generally arises early in chronic uveal tuberculosis.

Wiesner presented a child of 9 years with bilateral disseminate choroiditis and no central vision in left eye. Wassermann and tuberculin tests were positive.

Shields presented a man, aged 26, who had had active pulmonary tuber-

culosis for the past 5 years, and who, 2 years previously, had noticed that the vision of his left eye was failing. Right eye normal. The left fundus showed a number of small whitish spots around the macular region, especially between the macula and disc, i. e., guttate choroiditis.

In a man, aged 46, who died of acute miliary tuberculosis, **Gilbert** found a large inflammatory infiltration of the posterior pole and below the disc, and smaller infiltration toward the periphery and in the optic nerve. All, almost of the same age, showed granular disintegration, no caseation due, as Gilbert surmises, to an anaphylactic condition shortly before death. Numerous small thromboses and hemorrhages and the obliteration of many small vessels in the infiltration suggested an hematogenous origin and the beginning as endovasculitis, analogous to the papulonecrotic tuberculides. The case showed limitation of tuberculosis to the choroid and pigment epithelium. Edema and phlebitis of the retina are only results of irritation. Ophthalmoscopically recent tubercular inflammatory disseminated changes of the choroid are caused by the foci in the choroid and lesions of the pigment epithelium, not by deposits of exudations or connective tissue. The affection of the choroid in miliary tuberculosis must be considered as very frequent.

Under syphilis will be found the coincidence with tuberculosis in the same eye, observed by **Herrenschwand**; and under etiology **Mueller's** article on iridocyclitis with parotitis and its relation to tuberculosis, and those of **Mohr, Weve** and **Rieth. Aubaret** and **Ourgaud** report tuberculous gumma of the ciliary body.

Treatment of Uveitis.—Whatever may be the etiology of the causative toxemia, there are, according to **Wilmer**, certain principles of therapeutics that assist nature in rehabilitating the injured tissues. Eradication of all toxic sources, a simulation of nature's own measures by bringing increased numbers of leucocytes to the zone of activity, by hot applications, dionin and subconjunctival injections of normal salt solution. Any deficiency in the secretion of the glandular organs should be supplied by the proper organ therapy. The gastrointestinal tract must receive attention both in regard to diet and therapeutics. All these measures ought to be applied while the source of the toxin is under investigation.

While it is obvious that nearly every involvement of the anterior portion of the uveal tract will require the local use of atropin, Wilmer mentions the possibility, suggested by Rogers, of the patient with hypothyroid disturbance being unusually susceptible to atropin when in the least fatigued, owing to the failure both of the vagus and the sympathetic system.

Wilmer points out that long protracted ocular lesions are helped by the administration of the extract of certain glandular organs, such as thyroid extracts. The results, obtained by Veach from intravenous injections of boiled milk in iritis of rabbits, which he had produced experimentally, indicated that the course of the disease or infection was materially shortened in some instances, and only slightly influenced in others, but even here the results were not negative. He expects good, if not excellent results in the cases of iritis in which definite foci of infection cannot be found or demonstrated.

Gilbert's treatment of septic iritis, due to infection by staphylococci, with opsonogen will be found under etiology. **Rollet** and **Bussy** report nodular tuberculous iritis cured by radiotherapy.

Gonorrheal Iritis.—According to **Browning**, gonorrheal iritis is a toxic condition and not due to the presence of gonococcus in the eye, for this has been isolated from the eye in only one case (Sidler-Huguenin). He never saw it during the acute stage of urethritis. His object is to show that by proper treatment of the genitourinary tract and the cure of the disease existing there, a permanent cure of the gonorrheal iritis will follow. For the

radical cure he suggests: 1. Immediate treatment by the ophthalmic surgeon. 2. Immediate treatment by vaccines. 3. Continued treatment by vaccines and prostatic and vesicular massage with treatment of the urethra if necessary.

The immediate treatment by gonorrheal vaccines is essential. The acute attack is often cut short and the relief to the patient as regards pain is definite. Autogenous vaccine should be used if possible, but Browning found the French preparation, Dmegon and Mulford's vaccine good and reliable. The dose of vaccine varies with each patient. Browning used initial doses of from 5 to 500 millions with success.

Terrien, Debré, and **Paraf** published the results obtained with antigonococcic serum for gonorrheal infection of the globe. Inflammation was experimentally produced in rabbits by injecting gonococci into the anterior chamber of the eye. They found the serum of value only when it was injected into the anterior chamber. Intramuscular and intravenous injection did not modify the course of the disease.

Folman analyzed 93 cases of rheumatic iritis and found that in 47% of the cases there was a history of previous gonorrheal infection. The author thinks that in many of these cases gonorrhea is the etiologic factor; and advises the use of gonorrheal vaccine in protracted cases.

Treatment of Syphilitic Iritis.—**Dianoux** prescribed for a woman with acute iritis with multiple synechiae, in which quite recently mucous patches had developed in the throat, a collyrium of atropin and 3 gms. of aspirin to be taken in one dose, in syrup, at bed time. After 3 days all infection had disappeared and only one synechia remained. Dianoux hints that aspirin may be an antisyphilitic drug and suggests that the subject is worthy of investigation.

Abadie injected cyanid of mercury intravenously for the treatment of bilateral chorioretinitis.

Bulson recommends iridencleisis for correction of iridodialysis, and reports 3 cases with satisfactory results. **Bayer** reports a case of congenital iridodialysis. The observation of late infection in a case of incarceration of the iris by **Purtscher** is reviewed under etiology.

Tuberculous choroiditis is therapeutically very amenable to tuberculin. Vision often is improved by sufficiently long continued tuberculin cures. Relapses, however, are not rare, so that repetition of the cure at regular intervals are indicated. The necessity of giving very small curative doses of tuberculin at the start is emphasized by **Wilmer** and all ophthalmologists of large experience. **Bogardus** describes the method of treatment with T. R. at the Bellevue Hospital at New York.

Saupe reports on the treatment of tuberculosis with partial antigens according to Deycke-Much, which was adopted at the eye clinic of Prof. Stock at Jena since 1918. In testing whether it is an improvement over other methods, Saupe reached the conclusions that better results were obtained with partial antigens. The method is rather complicated and has the drawback that the partial antigens give very uncertain diagnostic clues, while therapy and prognosis are in a better position.

The tuberculin cure, according to **Hessberg,** does not always attain equally good results in uveitis, as in keratitis especially in plastic and serous iritis. In such cases recently the aurocantharidin preparation krysolgan, introduced by Spiess, proved useful. After a few intravenous injections of from 0.10 to 0.30 very obstinate opacities and deposits cleared up surprisingly. From 8 to 12 injections are required, which may be combined with high altitude solar radiations, and mercurials, with local treatment. Hessburg warns against too early iridectomy, which may be indicated to prevent secondary glaucoma, as it may stimulate new formation of tubercles and lead to the destruction of the eye.

Thomsen reports on tuberculin treatment of uveoparotidea.

Cohn reports on his good results with the instillation of hetol (sodium cinnamylicum) in tuberculous chorioretinitis. Two cases are reported in detail. He also used it in subconjunctival injections according to Oflügn, and intravenous injections according to Landerer.

Santos Fernandez reported a case of iritis in an elderly man which was benefitted by change of location. **Sage** discussed the treatment of iritis.

DEGENERATIONS AND ATROPHIES.—**Bane** presented a man, aged 62, who complained that following a fall down stairs the vision of the left eye had been poor. There was a dense opacity of left lens and the iris was tremulous.

Löwenstein observed in a short time 5 typical cases of vermiform contraction of the sphincter pupillae with the Nernst slit lamp, in pupils immovable to light; twice due to recurrent paralysis of the third nerve, once to reflex immobility, once total immobility, once amaurosis after embolism of the central retinal artery. He discusses three kinds of explanations. 1. Possible transfer from one muscular fibre to another. 2. Excitation of the muscular fibers by light, directly or thru the iris pigment. 3. The experimental proof that single ciliary nerves supply certain sectors of the sphincter, suggests that the majority of the sphincter nerves are paralyzed, while the function of some, altho damaged, is preserved. The consequence will be a circumscribed contraction of the pupillary margin. The focus of contraction, from which the movement spreads, would correspond to the insertion of the preserved fascicle of ciliary nerves.

Holloway and **Fewell** reported the history of a man, aged 53, who had had poor vision since childhood. He had high myopia but had not been able to secure satisfactory glasses. Vision reduced to counting fingers at 2 feet. Disc markedly atrophic with large excavation. Extending from the disc beyond the macular region and to the midzone above and to the nasal side below there was a wide spread sclerosis of the choroidal vessels. In this area all degrees of vascular change may be noted from delicate white vascular markings to complete fibrosis. Scattered about the periphery and central portions were discrete but small clumps of pigment. The retinal vessels were contracted to a minimum.

In a 53 year old man was observed by **Masuda**, a lesion running from the papilla under the retinal veins around the macular region in the form of a broad band-like atrophy of the choroid; the field of vision showed a ring scotoma. No similar case was found in the literature. The cause was apparently dependent on a sclerosis of the vessels.

The extremely rare gyrate atrophy of choroid and retina has been described in Argentina, only in 2 cases of Wernicke and Argañaraz. **Castro** observed the same in a sister of Wernicke's patient. The right disc was surrounded by atrophy of the choroid, veins and arteries thin. The choroidal focus formed a ring open upward, at the nasal side, one at the temporal side 2 disc diameters wide. The peripheral margin showed numerous concavities; and was surrounded by accumulations of pigment. In the whole periphery atrophic vessels and foci of the shape of bone corpuscles, but larger than in retinitis pigmentosa.

The choroid of the left eye, which showed similar changes, was preserved only in an area of almost 4 disc diameters. Secondary cataract in both. A brother, who was not examined, was said to have poor vision and marked hemeralopia.

Holm observed a woman, aged 48, with symptoms of beginning glaucoma of right eye. Three weeks after Elliot's operation vision had disappeared and the eye which acted like malignant glaucoma had to be enucleated. Microsopic sections showed excessive atrophy of the whole uveal tract. **Stillwill** exhibited a specimen of bony formation, surrounding the optic disc in an atrophic eyeball. The patient, who

was 33 years of age, had received 24 years previously an injury to the eye from explosion of a dynamite cap. The eye was removed on account of chronic irritation.

The articles of Mas Soewarno, Swift, Fuchs, Vogt, Koeppe, Larsson, Waardenburg and Chance will be found under anomalies.

Iris Cysts.—A quadrant of the right iris of **Fischer's** patient, aged 56, bulged considerably, and a dark brown smooth body, 2 to 3 mm. which, projected from under the pupillary margin, moving with the pupil. On diascleral transillumination it remained dark. The lack of pigment accumulations on the iris and of hypertension excluded a melanotic tumor and suggested the diagnosis of cyst, which was excised. It contained clear fluid. The iris was normal in its whole thickness, but a uniform layer of pigmented cells, similar to the pigment layer of the iris formed the posterior wall of the cyst.

Berg observed a typical serous cyst, 4 mm. in diameter, on the iris of a man, aged 23, adherent to a leucoma from an injury 11 years previously. The cyst was removed, but returned after a few weeks and was again removed. Two and a half months later a fine grey membrane developed on the lens which partly regressed and again progressed. Berg considered it as a proliferation of epithelium of the cyst with temporary shrinking of the cells. The phenomenon is analogous to epithelial proliferation in the anterior chamber after cataract extraction and in secondary glaucoma.

Cohen presented a patient, aged 32, with a large implantation cyst of the iris on the nasal side. Three years ago the eye was struck by a penetrating chip of steel which was removed thru the nasal side of the corneoscleral margin. The cyst was of mother of pearl appearance and translucent, probably due to a downgrowth of corneal epithelium which was implanted on the iris. The contents consisted of granular detritus, fibrous elements, a few tinged with pigment, and fine strands of tissue. By transillumination one perceived a reddish reflex on the area of this mass, indicating the pigment epithelial layer had become degenerated and absorbed and then replaced by the proliferated epithelium which lined the cyst wall. The pupil did not react at all. **Latil** and **Ourgaud** report traumatic cyst of the iris.

Rados described clinically and histologically 2 cases of congenital cyst in the mesodermal portion of the iris in men, aged 35 and 36. The term congenital here means that the conditions of the development of the cysts were created during fetal life, and that on this basis the cysts formed in later life. Both were embedded near the pupillary margin in the anterior layers of the iris, so that the anterior wall was covered by a very thin layer of iris, while almost the entire iris formed the posterior wall. The cysts were lined with typical epithelial cells. In the second case a marked homogeneous basal membrane was between iris stroma and epithelium. In both the epithelia were pigmented, in the second case so intensely that the pigment granules were encountered not only in the cell protoplasm, but covered the nucleus in some cells. In this case there was also secondary glaucoma, which was cured by removal of the cyst. The various views on the development and interpretation of these formations are discussed in detail.

Rumbaur observed, 5 months after a perforation of the cornea with prolapse of iris, which was abscised, and entrance of 2 cilia into the anterior chamber, a pearl cyst of the iris. Histologically the removed cyst originated from the hair follicle of a cilium. Between the hair follicle and germ cells layer a fissure developed by the abnormal growth of the germ cells next to the large vessels of the iris, this part having a better nutrition, and manifested itself in intense keratohyalin formation. Gradually the fissure waxed to a cyst, filled with cast off cornified cell lamellae, which became round and of pearl luster.

In a patient of **Demaria**, a woman, aged 51, a serous cyst developed spon-

taneously from the temporal side, occupying 1/3 of the iris. It was removed within 2 weeks by bipolar electrolysis of 4 milliamperes in sittings of 4 minutes after both needles had been introduced into the cyst. An anterior synechia remained at the puncture, and an opacity of the lens followed, interfering considerably with vision.

Neeper presented a woman of 40 years who in the past year had several attacks of iritis in the right eye. The last attack, a month ago, had left a permanent posterior synechia with elongated pupil, thru which a white mass could be seen well forward in the anterior vitreous. It was growing and had crowded the iris forward more than it had been 9 days previously. Tension normal. The patient had first noted a film coming over the sight of this eye a year ago. Her father had died of cancer. Enucleation had been advised. In the discussion, **Coover** and Finnoff suggested the diagnostic use of tuberculin with great caution on account of the possible tuberculosis of the retinal vessels.

Sympathetic Disease

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This section of the digest carries the literature from March, 1920, to April, 1921. For previous literature see O. L. v. 16, p. 116.

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DIGEST OF THE LITERATURE

PATHOLOGIC ANATOMY.— **Guillery's** communication consisted of a review of the different opinions regarding the interpretation of the anatomic findings in tuberculosis and sympathetic disease. He pointed out the many difficulties of the situation including the frequent failure of inoculation and finding of bacilli. He emphasized the accumulation method after treating the tissues with antiformin but warns against the use of Mueller's fluid which inhibits the staining of tubercle bacilli.

The eyeballs were fixed in formalin or sublimat, and after washing and treatment with iodin in alcohol, hardened in alcohol up to 96%. Then the eyeball was sagittally cut in half. The uvea of one-half was cut in smaller pieces, placed in 15% antiformin solution, and put into an incubator. After about 5 hours everything was dissolved. The centrifugate was transferred to a slide, fixed over a flame and stained according to Ziehl-Neelsen, or partly according to Much. The other half was used for histologic examination. He examined various tubercular organs of man and animals and found in almost all cases the bacilli.

The histologic examination of an eye enucleated on account of chronic iridocyclitis, phthisis, with nodules in both irides, showed in several hundred sections no typical tubercular foci; but the antiformin method rendered the bacteriologic diagnosis probable. In the eye of a child who had died from general miliary tuberculosis, the choroid presented anatomically nodules of typically tubercular structure, many giant cells and partial tyrosis, but no tubercle bacilli. The centrifugate shows on the slide easily detectable bacilli.

To prove the method rabbits were inoculated intravenously with tubercle bacilli. Anatomically there was infiltration of the iris with lymphocytes, diffuse and in small foci; and in the choroid small foci of round and epithelioid cells, no giant cells. The other half of the eye treated with antiformin showed bacilli. The method is recommended in uveitis of unknown origin in the hope that our knowledge of ocular tuberculosis will be increased.

Meller's early reports mention a tumor like mass in the anterior segment and a diffuse swelling of the

choroid in the posterior segment in places 2 mm. in thickness. His two cases reports show besides the changes in the uveal tract distinct necrosis.

Case 1. An eight year old girl's left eye was struck by a twig three weeks before. There was marked inflammation followed in six days by involvement of right eye. Left eye marked injection of the cornea around a flattened scar to which the iris is attached posteriorly. Pupil appears as a dark spot, tension decreased and light perception uncertain. Right eye marked injection with deposits on Descemet's membrane, cloudy aqueous, iris structure indefinite and some posterior synechiae. Tension normal. Enucleation of the left eye, with a malignant course in right eye ending in blindness despite treatment for months. Lymphocytes 35%.

Histologic findings.—Iris and ciliary body displaced by tumor mass involving anterior chamber and cornea. Structure of mass with naked eye appears to be made up of nodules with necrotic centers. Tumor mass made up of granulation tissue, consisting of masses of epithelioid cells and giant cells surrounded by lymphocytes. Region of pupil filled by connective tissue and round cells. Retina in mild degree of inflammation with perivascular lymphocytic infiltration. In the anterior part of choroid are distinct masses which blend posteriorly in an even thickness of choroid. In the region of the nerve head the choroid is thickened to 1 mm. and small masses of epithelial cells are present on the inner surface of the pigmented layer. Papilla swollen pushing the retina aside, and being covered with a fibrinous exudate. Around the vessels there is round cell infiltration. Distinct infiltration around the blood vessels and nerves of the sclera. In the center of the mass there is a typical necrosis with fragments of pigment, towards the edge of which the nuclei are distinct. Necrosis is found only in the anterior large tumor mass due to the lack of blood supply as no vessels were found nearby. Bacteriologic examination negative.

Case 2. An eight year old boy had scarlet fever in 1906. During Christmas was struck in the left eye with a pair of scissors and treated elsewhere. By February 14, 1907, the right eye had been involved for two weeks. Left eye presented marked ciliary injection with retracted scar thru the cornea near the upper limbus ending in the sclera Otherwise, the cornea was smooth and glistening. Anterior chamber obliterated. Pupil drawn outward towards the scar and filled with connective tissue bands. Color of iris washed out, in the pupillary zone yellowish brown, but darker peripherally with new formed blood vessels; and increased tension. Right eye, ciliary injection. Sclera above, near the cornea bulging with a bluish discoloration, reaching 3 mm. posteriorly. Cornea clear and glistening, anterior chamber obliterated. Pupil drawn upward so far that a portion lies under limbus. Margin of iris near the pupil yellowish brown, almost black in the periphery with many newformed blood vessels. Ophthalmoscopic examination impossible. Uncertain light perception in both eyes with plus tension. February 19, 1907, enucleation of left eye. Iris and ciliary body replaced by a tumor with choroid thickened to 2 mm. and the other findings similar to the first case, except that the retina shows no inflammatory reaction other than a perivascular infiltration. The papilla showed a mild edema and was covered with an exudate. Bacteriologically negative.

Clinical Cases. **Moulton** reviews his experience with four cases. Case 1, a boy of 13 was shot in the right eye with a 0.22 pistol which perforated the sclera near the ciliary region. Enucleation was advised but refused. A month later the other eye was involved and the injured eye enucleated. The patient was put on atropin and large doses of sodium salicylat. About four and a half years later the boy was again seen, the remaining eye was congested and sensitive to light with many brownish spots in the cornea especially across the pupillary area and fresh Descemet's deposits. The pupil was 4 mm. in diameter, stationary, with a total flat adhesion of the iris to the lens. Atropin was without effect. Lens capsule hazy at the margin but the center was clear, with fundus reflex

but no detail. Vision 20/100. Field normal. Intraocular tension normal. The man weighed 180 pounds and was given 20 grains of sodium salicylat every hour and a half until nine doses were taken. This with free diaphoresis was repeated for five days. After three courses of this dose for five days each with a two day interval the dose was dropped to 100 grains a day for the same periods and same intervals. The patient was decidedly better after the first course of treatment. The deposits on Descemet's membrane lessened. Vision improved to 20/80 and forty days later 20/30, with disappearance of all redness and irritation the only opacities remaining being those deep in the cornea. The patient has had three relapses as above described in the past eight years. All have responded to the same treatment. Vision remains around 20/30. During the first attack it was found that he had a chronic suppurative inflammation of the left antrum. This was opened but relapses were not prevented.

Second case, a man of 58 was blind in his left eye with absolute glaucoma. The media clear, disc deeply cupped, tension 50. The right eye perfectly normal with vision 20/20. After a mule shoe drain operation in the blind eye, there was so decided an inflammation that the eye was enucleated 68 days later. Three days after enucleation the vision of the remaining eye was 20/20 but there were fine deposits on Descemet's membrane which, however, had disappeared five months later. The eye was white and without inflammatory signs. Vision 20/30. Uveitis with steadily failing vision progressed until one and a half years later the eye was blind and the pupil blocked with exudate, tension minus.

The third case was a 22 year old man who had been injured four days before his first visit by a piece of steam pipe bursting and injuring the left eye and eyelids. Panophthalmitis developed and the eye was eviscerated. About a month after the evisceration the patient complained of dim vision. The remaining eye was slightly congested with deposits on Descemet's membrane and the anterior capsule of the lens, iris retracted at the base, pupil 4.5 mm. reacting slightly to light, dilated under atropin, fundus normal. Vision had dropped from 20/20 to 20/60. Accommodation lessened. The eviscerated stump was dissected out. Patient weighed 140 pounds and was given 140 grains of sodium salicylat daily. Improvement began in twenty-four hours and in one month the eye was normal with 20/20 vision.

The last case was that of a boy aged four who had been struck in the right eye two months before by a stick of wood. There was a depressed scar extending from the center of the cornea down and out into the sclera. The iris was adherent to both cornea and lens. Complete occlusion of the pupil. The eye was blind, congested, tender, with minus tension. After using atropin the vision equaled fingers at three feet. The injured eye was immediately removed and the patient weighing forty pounds given forty grains of sodium salicylat daily. The adhesions of iris persists but there is fairly clear pupil and vision 20/30. Moulton lays emphasis on the large doses of salicylat and ascribes his good results to its use.

Wiener's case was first seen in 1907, the left eye was injured ten years before with a pair of scissors, and the right struck with a baseball six years later. From the time of the first injury there had been recurring attacks of inflammation in the left eye and after the baseball accident the right eye had similar attacks. He had been advised elsewhere to have the left eye enucleated. The first examination made in 1907 showed the vision of the right eye 20/200 with pupil bound down and iris bombé. Pupillary space closed by a thin membrane and vitreous too hazy for fundus detail. Tension slightly raised. The left eye vision 20/70 pupil drawn up and in with anterior synechia and closed with a thin membrane. The anterior segment gave all markings of plastic iridocyclitis. The vitreous was too hazy for fundus examination. In both eyes Descemet's deposits. An iridectomy was done on the right eye. The patient was given pilocarpin injections, large doses of iodid of potash and salicylat of soda. In four months the vision had improved in the right eye to 20/30 and

the left to 20/50. The disc of the right eye was distinctly blurred with evidence of a low grade optic neuritis. No contraction of the field to white or colors. There were a few depigmented spots in the macular region. Fundus of the left eye remained indistinct.

Treatment.—Several times in the next six months the inflammation started again, the vision being reduced to 20/70. From 1908 to 1914 there were repeated attacks first of one eye and then the other. In May, 1914, both eyes were involved at the same time and the vision reduced, altho finally it was brought in the right eye to 20/40 and the left to 10/200. There were many attempts to make a pupil in each eye but all failed following severe reaction. It was impossible to find any etiologic factor; Wassermann, fixation tests, nasal sinuses, teeth, chest and general physical examination all negative. Tonsils were removed and teeth treated for suspicious foci. In February, 1919, the vision of the right eye was fingers at two feet and the left eye fingers at one foot. Tension: Schiötz, 10 in the right eye and 8 in the left. Projection remained good in both eyes. Altho the anterior chamber was fairly deep the iris was discolored and atrophic. By September, 1919, there was only light perception in both eyes. Vaccination was then given by **Bonime** both intravenously and subcutaneously. After six weeks the patient was operated upon. The tension of the right eye practically normal and projection perfect. Vision hand movements. Attempted iridectomy was only partially successful because of the atrophic iris. Later the iris was free and the lens removed by discission. At no time was there any reaction. The final result with correcting glass was 15/200.

Immunization was started after tuberculosis had been excluded. Typhoid bacilli were given intravenously. An autogenous streptococcus vaccine made from organisms obtained from the tonsillar region was given subcutaneously in increasing doses until three days before operation he received 300 million of each. Beginning with twenty-five million typhoid bacilli intravenously there was considerable reaction with a rise in temperature. The reaction was less after each injection until finally no reaction was observed.

The deduction drawn from the paper is that following the injection of a foreign protein there is produced in the body an increase of the patient's defense against organisms. The case seems to be a bilateral severe iridocyclitis.

Thompson's patient was a girl of six who was struck in the left eye by a stone which caused a severe lacerating injury. Enucleation was advised but rejected. Sixteen days later the patient returned with iris of a greenish hue and tension minus. Again enucleation was advised and refused. Twelve days later she returned with the right eye slightly inflamed and marked photophobia. The pupil was contracted and reacted sluggishly to light. Enucleation was then done. After several weeks of moderate disturbance and in spite of treatment the eye grew worse. The cornea and aqueous remained clear. There was, however, ciliary injection, iris discoloration, posterior synechiae and an exudate in the pupillary space, with vision equal to fingers at four feet.

Jackson in discussion said that the majority of the cases which he had seen had been in children. The prognosis was worse in children and worse in younger than in older persons. Crisp in discussion refered to the influence of focal infections and Walker gave his experience with a case from which a piece of steel had been removed from one eye with a magnet. A short time later, the other eye developed iridocyclitis. The injured eye was immediately removed. His last report from the patient was barely light perception in the remaining eye.

Dennis details a case of what he terms *sympathetic glaucoma* nine months after enucleation. The injured eye was removed within two weeks of the accident, which was caused by a piece of steel striking the eye. A local physician had failed to remove the foreign body with a magnet, altho the X-Ray localized it deep in the vitreous. There was a small, central, penetrating wound of the cornea with some ciliary injection and a slight

hypopyon. The lens was opaque, vision light perception. Vision of the left eye 20/10. The foreign body was extracted by the Haab and a small hand magnet. The anterior chamber was opened at the time of the extraction and the hypopyon was also removed. For thirteen days the eye remained fairly quiet then the hypopyon returned. The eyeball was tender and painful. The left eye still had normal tension and vision of 20/10. The right eye was removed and a gold ball implanted in Tenon's capsule. Healing uneventful. Eight months later he reported that four or five days before he had noticed a halo around lights with failing vision. The pupil was dilated but active with no pericorneal injection. There were many desposits on Descemet's membrane but no exudate in the pupillary area or in the vitreous. Tension by the Schiötz 30. The only abnormality in the field of vision was an enlargement of the blind spot. After a hospital stay of twenty days, where he was given pilocarpin and mercurial ointment, homatropin and eserin alternately, he was discharged with a quiet eye. Vision 20/10. Thirteen months later he had a similar attack, underwent the same treatment, made a good recovery and was quiet until about two and one-half years later when he went thru the same process. He recovered and up to the present time has had no recurrance. The lymphocyte count showed at no time an increase in small lymphocytes or a decrease in the polymorphonuclears and the X-ray examinations of teeth and sinuses were negative.

Hirschberg reports a case of sympathetic inflammation observed over twenty years in a boy aged 7 years first seen in 1898. The left eye was injured in 1895 and subsequently enucleated. This case was previously reported in 1900 and 1901. In 1918 vision in the right remained 1/15, and the cornea was clear. Hirschberg considers the condition all the more remarkable as during the treatment for sympathetic ophthalmia he had performed an operation for soft cataract. **Demaria** reports a penetrating wound of the eye followed by bacillus subtilis infection.

General Papers. **Goto** reports three cases of metastatic ophthalmia, one tuberculous with choroidal involvement, the second cerebrospinal meningitis and the last of hidden origin. **Burchardi** reports sympathetic ophthalmia after exenteration; **Mann** considers focal infection a factor in inflammations following operation or injuries. **Wetzel** reports sympathetic ophthalmia with disturbances of hearing, and **Peters** writes on sympathetic eye diseases for the five hundredth anniversary of the University of Rostock. **Demaria** reports on a penetrating wound of the eye followed by bacillus subtilis infection.

Glaucoma

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This review brings the literature of the subject from April, 1920 to May, 1921. For previous references see O. L. v. 16. 1920. p. 123.

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DIGEST OF THE LITERATURE

PHYSIOLOGY OF OCULAR TENSION. **Magitot** and **Bailliart** consider the oculocardiac reflex and the variations in the ocular tension a trigeminal-vago-sympathetic reflex, in which the vagus or the sympathetic factor predominates according to circumstances. The results of experiments on animals and man are detailed in this paper.

(1) In man a weight of 150 grams is, in general, necessary to elicit the reflex; in the dog, 150-200 grams.

(2) Subconjunctival injection of a physiologic serum did not cause the reflex, while injection of a 10% NaCl solution caused it immediately. This was caused neither by its mass, nor by the increase in ocular tension, which

was not manifested for 15 minutes, but by its irritative action on the nerves.

(3) Hypertension caused by injections into the vitreous never evoked the reflex, whereas injections into the anterior chamber often did, probably by compression of the nerves going to the iris and cornea. The influence of the iris is shown by a case of dislocation of the lens, in which the reflex appeared whenever the lens pressed on the pupillary margin, and disappeared when this was overcome.

(4) The reflex can be caused even in the absence of the eye, showing that other fibers of the trigeminus can cause it when irritated.

They conclude that there is nothing especially ocular about the reflex, and that it is a common physiologic reflex with little of clincal value attributed to it.

Bonnefon, writing on the circulation of the choroid and ciliary body in relation to the ocular tension and secretion of aqueous humor, points out that the mass of blood in the intraocular vessels is but a small part of the fluid contents of the eyeball. He takes exception to the rule that the uveal tract may be regarded as an erectile tissue. Equatorial incision of the globe produces normal softening to escape of vitreous without hemorrhage. Section of an eyeball showing 90 mm. tension proved that the choroid was entirely devoid of blood. Experimental or operative division of the vortex veins does not produce hemorrhage. He thinks rather that the choroid must be looked on as a venous reservoir in which the circulation is very feeble.

Weiss, to determine the relative pressure of the vitreous and anterior chambers, inserted a canula into the superior vena vorticosa of a rabbit's eye and connected the canula to a manometer; also a canula was inserted into the anterior chamber and likewise connected to a manometer and readings taken. Four rabbits were used in the experiment. The ratio of the pressure in the anterior chambers and the veins were 10 to 12, 10 to 13, 10 to 14, and 10 to 19.

Control of Tension by Osmosis.—**Girard** and **Morax** report the results of a series of experiments carried on over two years, in which the living eye of the rabbit, in situ, was subjected to changes in osmotic pressure by passage of the aqueous current thru solutions kept in contact with the cornea, and the intraocular tension was measured by modification of Wessly's manometer. They find that it is easy by selected osmosis to modify at the will of the experimenter the ocular tension of the living eye, so that it can be doubled or reduced to one-third or one-fourth of the normal. These results can be obtained without lesions of the cornea. After subjection to such experiments the eye may return to its original condition and tension in about half an hour.

By a special recording device, **Mazzei** was able to record the intraocular tension simultaneously either with the carotid blood pressure, the jugular blood pressure or the endothoracic air pressure. The marked rise of *arterial pressure* produced by adrenalin and also the marked fall in pressure produced by sodium nitrit were reflected by a similar rise and fall in the intraocular tension. Smaller changes in the arterial pressure, however, due to struggling or quickened action of the heart were not reflected in the intraocular tension.

Changes in the *jugular pressure* produced by struggling were always accompanied by a similar rise in intraocular tension. This was true of changes in thoracic pressure, probably due to the effect of positive or negative pressure in the chest on the large veins in the neck. The author also found that tying off both superficial jugular veins raised the intraocular tension two to three millimeters, and tying off both superficial and one deep jugular raised the intraocular tension five millimeters. Tying off one deep carotid artery lowered the tension about three millimeters.

The author concludes that there is a definite relation between the blood vascular system and the intraocular fluids which is shown especially by the relation between venous pressure and intraocular

tension. This intimate relation, he believes is due to the effect of venous congestion in filling the venae vorticosae with blood and hence raising the tension. The practical deduction from this is that in treating high intraocular tension, all obstacles to the venous circulation must be removed and anything which increases intrathoracic pressure must be avoided. The literature is discussed and a bibliography of sixteen titles is appended.

Bailliart describes his method for determination of the blood pressure in the branches of the central retinal artery. In order to know the *retinal blood pressure*, we have to measure the pressure on the ball necessary to make retinal pulsation appear and disappear, and then to know how the chamber pressure has been modified at those moments. A dynamometer that acts by means of a special spring has been devised. The end of the apparatus pressing on the eye, the amount of force employed at any moment is indicated in grammes by a scale on the sliding shaft of the instrument.

The dynamometer must be applied in the region of the external rectus after the use of a few drops of holocain. The pressure is made toward the center of the ball, and is gradually increased until the observer sees the first pulsation of the retinal artery. Then he turns the light of his ophthalmoscope on the scale of the dynamometer and reads the force which he is employing at that moment, and next reads for the second time the figure on the scale. The changes in the chamber pressure are measured with a Schiötz tonometer.

In opposition to Leber and Wessely, **Hamburger** contends, as set forth in his book on "The Nutrition of the Eye," 1914, that there is no distinguishable or measurable secretory current in the eye; but merely a cellular metabolism between the spaces filled with fluid and all adjoining tissues analogous to the process in other cavities of the body. The metabolism of the iris is more active than that of the ciliary processes, which are built on the type of the corpora cavernosa and have the static function to withhold the accommodative pressure of the lens from the iris and cornea. Thus they are lacking in the eyes in which the accommodation occurs by backward movement of the lens. Hamburger does not deny a slight secretory activity of the ciliary processes for the scanty nutrition of the lens and vitreous. Anterior and posterior chambers are separated by an absolutely water tight valvular closure; of which we do not know how often or how rarely it is broken.

These views have been partly adopted by Berg, Meller, Magitot, Bruckner, Roemer and Weiss, and opposed by Seidel who upholds Leber's theory. Hamburger criticizes in detail Seidel's article and experiments under the headings of the source of supposed current in the eye, current and outflow. The assumption of a filtration from the anterior chamber into the canal of Schlemm has become impossible. Hamburger emphasizes that for maintaining the status quo, a healthy iris, a "suction sponge" with its pores directly immersed in the aqueous is really more important that the canal of Schlemm. He considers glaucoma due to a direct irritation from the central nervous system. It is therefore entirely irrelevant whether iridectomy, cyclodialysis or trephining be performed provided that the peripheral irritation is strong enough to overcome the central. He does not believe in the mechanical explanation of this action as there is no filtration in the scars left by them according to experimental physiologic experience. In glaucoma the inflow is greater than the outflow, and the operation serves only to check by reflex the inflammatory inflow. Iridectomy in glaucoma simplex must do more harm than good by further reducing the scantily absorbing surface of the atrophic iris. Who wants to operate may resort to sclerotomy or cyclodialysis, but for ten years Hamburger has advised against iridectomy. He concludes by declaring Leber's doctrine of the nutrition of the eye wrong.

TONOMETRY.—**Schiötz's** communication is a return to the study of the problems of tonometry after a silence

of several years. After the introduction of the Schiötz tonometer there arose from the profession criticism of the instrument, which led to modifications of it by other workers. Now Schiötz states that his "aim is partly to improve the instrument if possible, partly to extend our knowledge of the mode of action of the tonometer and partly to check and correct the curves, the construction of which I based on not more than eight enucleated eyes." The author treats of the plunger and the influence of the shape of the end of the plunger, on the deflections of the pointer, the weight of the tonometer, the foot piece tonometer graphs, the standardization of the tonometer and two new tonometers. The discussions of his experiments are illustrated by fourteen tables. Schiötz's tonometer should be the most accurate guide to a good prognosis. If repeated tonometric examination does not show an increase in ocular tension, myotics will suffice for treatment.

Cameron gives a critical review of the subject of intraocular pressure, bringing his review to date. **Hertel** dissents from the views of Leber and others as to the intraocular pressure depending closely upon the arterial tension. He points out that in Graves' disease intraocular pressure may be low (12 mm.). But that in hypothyroidism (myxedema or marasma) the ocular tension was often relatively high; 30 mm.

Jackson points out that our knowledge of intraocular pressure has been extended and made more exact by the introduction of the tonometer, but the number of our problems has been increased. From the use of such an instrument we soon learned that its readings do not tell us the absolute intraocular pressure. But when compared with previous readings from the same eye they tell us with great certainty of the direction and extent of changes in pressure, and when compared with those of the fellow eye, they indicate with great probability the differences of pressure between the two. Nor has the tonometer definitely determined the limits of normal intraocular pressure either in millimeters of mercury or in the reading of the instrument.

Simple glaucoma may exist without increased intraocular tension and on the other hand very striking increase in intraocular tension, pressure 50, 60, or even 70 mm. Hg., may be found in connection with uveitis or other uveal disease, and this pressure drop to between 20 or 30 mm. Hg. in a few days without any loss of vision or signs of glaucoma.

Butler has devised a tonometric chart by which he is able at a glance to grasp the tonometric history of a patient. The chart records the tension of each eye, the date it was taken and any operations performed and their date. The object is to save the time of the doctor in grasping the previous history of the patient.

McLean also reports a fourth human eye in which he took readings with the Schiötz, and the McLean tonometer and compared them with the reading of the manometer. The result with Schiötz 43 mm. Hg., McLean 62, and the manometer 65 mm. Hg.

Nicati's valuable contribution to ophthalmotonus, with full biblography, should be studied in the original as he covers the physiologic and pathologic aspects of the subject, and devotes one chapter to the observation of 185 cases of average intraocular tension.

ETIOLOGY.—**Lagrange** states that glaucoma has its start in an excitation of the sympathetic vasomotor setting up a hypersecretion in the gland of the aqueous humor. Just as the cheeks flush when one has been insulted, so the ciliary nerves of the glaucomatous subject speed up after a deep emotion, or an excitement of a psychic, moral or physiologic nature. In the beginning there is always some nervous excitement underlying every glaucoma, and all glaucomatous subjects have a neuropathic strain in them. After an eye has been the seat of several outbreaks the media are altered the filtration angle is clogged with waste, the debris of dead cells and extravasated blood cells, and the drain at the filtration angle ceases to play its part.

To the hypersecretion is added hypoexcretion, especially in angiosclerotics in whom the sclera is very rigid and the vessels without elasticity. Such are the features of the pathogenesis of glaucoma.

Hambresin reports the histories of two women about 48 years old with three diopters of hyperopia in whom acute glaucoma came on after instilling homatropin. In both cases the pupil was of average size before the drops were instilled, the reflexes were good and there was no sign of hypertension.

Lagrange remarked that in the clinic of Bordeaux, they used homatropin even to excess in the courses on ophthalmoscopy, in spite of which he had never seen a case of glaucoma supervene. Before him Badal used atropin freely to dilate the pupil, during the 27 years in his service and not a single case of glaucoma occurred.

The real reason for the outbreak of glaucoma in Hambresin's cases is neuropathy, a peculiar excitability of the sympathetic roused into action by the excitement of an ocular examination.

Gifford calls attention to the danger of overlooking chronic glaucoma lurking behind a beginning cataract. Chronic glaucoma is about 6 to 8 times more prevalent than the acute variety, and the subjective symptoms of beginning cataract and chronic glaucoma, are so much alike that the loss of vision can usually be accounted for by the lens opacity, and the glaucoma can quite easily be overlooked. Strict attention to the tension of the eye and the fields and what can be made out of the fundus thru a dilated pupil should constantly be kept in mind.

Werner showed a case of glaucoma with cataract, which had been trephined for glaucoma. He extracted the lens in the usual manner. He thought that there was no danger in the incision passing thru the trephine hole. He thought it unwise to trephine below in such cases primarily, owing to the great liability to infection and injury. **Wessely** reports a case of peculiar glaucoma.

Alonzo arrives at the following general conclusions in the early treatment of glaucoma. 1. Early surgical intervention is the rational treatment, but where the patient refuses operation, then the oculist may use myotics. 2. An early analogous conduct should be followed in the treatment of chronic irritative glaucoma, recalling that the probabilities of retaining acute vision shall be in inverse ratio to the number and intensity of acute attacks occurring before operative interference.

Garza states that glaucoma is a general disease with local manifestations in the eye. In addition to hypertension there must be the usual predisposing anatomic conditions. The causes of glaucoma are: 1. Oscillations of circulation, or disturbance in the innervation of the vessels. 2. The emotions. 3. Mydriatics. 4. General disturbances due to modifications in the endocrin glands. 5. Infections, as influenza, typhus and pneumonia.

Montaño defines glaucoma and refers to it as an edema of the vitreous humor. He studied the effects of this edema, and the causes producing it. He divides treatment into hygienic, medical and surgical.

Smith has a very interesting article on the etiology of glaucoma. The author aims to reclassify what we know about this interesting and absorbing subject.

From a review of his own cases to ascertain possible etiologic factors, **Posey** found nothing tangible, with the exception of gout or a rheumatic tendency. Ophthalmoscopically, the first thing to excite suspicion of glaucoma is the tendency of the scleral ring to become visible all around the disc.

Nadal believes that since the cause of glaucoma remains unknown to us the early treatment must be symptomatic. The acute symptoms must be quieted before proceeding to operative treatment. He employs iridectomy after von Graefe.

Alonzo published an historic review concerning the theories of the etiology and pathogenesis of glaucoma and the methods for its surgical treatment.

DIAGNOSIS.—**Elliot** states that the

chief diagnostic symptoms are grouped under general heads. *Headaches.* 1. A passing morning headache; not all morning headaches are indicative of glaucoma, some may result from eye strain. 2. Headaches after near work are frequent in middle life and after are common. If all refractive errors are corrected and muscle imbalances remedied and presbyopia provided for, and still there are headaches, the surgeon should remember the possibility of glaucoma as a causative factor. 3. In an elderly patient suffering with severe headache, associated with vomiting, you should think of glaucoma.

Loss of Sight. Gradual loss of sight without any apparent cause. (a) The rapid increase of presbyopia. (b) The visual field will gradually shrink. (c) The light sense may be greatly reduced.

Chronic glaucoma may be confused with cataract, refractive errors, brain trouble, optic atrophy; gradual loss of sight with intermittent headaches; marked loss of sight clearly following severe headaches. (a) photopsiae, (b) halos.

In an address before the British Medical Association, **Elliot** discussed the diagnosis of glaucoma from a different viewpoint. Beginning wth Hippocrates, he briefly outlined the history of the development of our knowledge of this disease, referring to the invention of the ophthalmoscope by Helmholtz, the discovery of cupping of the disc by Wever, the introduction of miotics by Laquer, 1876. In 1857, von Graefe introduced iridectomy in the surgical treatment of the disease. The great work of Priestley Smith was mentioned, and the advance in the surgical treatment by Lagrange. The methods of diagnosis are outlined. 1. The ophthalmoscopic evidences of increased tension. The cupping of the disc, venous and arterial pulsation. 2. Tonometry. 3. Perimetry. Elliot reaffirms his strong conviction that the perimetric examination of the patient when suitably conducted furnishes alike the most delicate and the most reliable indications of the presence of glaucoma, of the progress that the disease is making, and of the value of any method of treatment, whether medical or operative. 4. Examination of the light sense. 5. Measurement of the diameter of the cornea.

In discussion, Henry called attention to the assistance in differential diagnosis of glaucoma in its very earliest stages to be obtained from a careful study of the light minimum perceptive power. He could confirm Samelsohn's statement that in the earliest stages of glaucoma there was a rapid reduction in the light minimum sense, but a very slight reduction in light difference sense. Wherry asked Elliot's opinion of Fischer's colloidal theory of glaucoma. Pockley thought that there was danger to the cornea from the use of the tonometer, especialy when the instrument was used carelessly.

Elliot in reply to Henry stated that we have no instrument for testing the light minimum and the light difference senses that is available for practical use. He said in reply to Wherry's question that sodium citrat treatment had been disappointing clinically. And in reply to Pockley stated that the use of a small quantity of liquid paraffin to moisten the piston of the footplate of the tonometer, was a great protection to the corneal epithelium. These old people should be kept under observation for 24 hours after tonometry, and 12½% sol. argyrol should be instilled in the eye at 3 hour intervals.

Atkinson gives a review of the differential diagnosis between glaucoma, iritis and conjunctivitis, with the medical treatment of glaucoma.

Ohsaki studied the intraocular tension in a patient aged 41 who was suffering from bilateral rodent ulcer of the cornea. He considers that the intraocular tension is greatly influenced by the elasticity of the cornea.

Clinical Cases.—**McMullen** showed a case of congenital anirida associated with some signs of glaucoma. The discs seemed definitely cupped, and palpation seemed to indicate a raised intraocular tension. Harman, in discussion, suggested cyclodialysis in this case on the ground that the procedure was usually satisfactory and produced the least interference in an eye in re-

gard to which one was doubtful whether an interference should be undertaken. Juler thought a trephine was apt to injure the lens. Mayou's experience was the reverse. He had trephined a case of aniridia with good results.

Thibert reported a case of traumatic glaucoma coming on two weeks after a contusion in the region of the upper lid. The increased tension was of 40 days duration without change in the pupil or contraction of the visual field. While in the recumbent position, the tension was 12 mm. higher than in the sitting position. This difference is explained by the greater flow of blood to the head, the eye having lost its power of vasomotor regulation. Under the same conditions normal persons show no increase of tension, so one is forced to assume a lesion of the sympathetic ocular center of the eye.

Smith showed a boy 12 years with absolute glaucoma. The eye had always been myopic and almost amblyopic. There were extensive areas of atrophy in the retina and choroid, the other eye was emmetropic. Two months ago the boy had come with a widely dilated pupil, cloudy cornea, slight ciliary redness and high tension. There was no vision. There was a history of a red and painful eye some months previously, for which he had not sought treatment, and there was evidence of iritis in the presence of a ring of pigment on the lens. The case was evidently one of secondary glaucoma.

Faith selected four cases of glaucoma to illustrate problems in glaucoma. The first case was one of chronic glaucoma. The lens was swollen, the media was clear, and tension was +2. Seven months afterward the lens was opaque, and the tension normal and the eye was quiet. The second case showed a ring of choroidal atrophy around the disc, one-half the disc in diameter when first seen and early in the disease. His third case showed the futility of always pinning our faith to myotics alone. His fourth case had a tension of 75 mm. with a mobile pupil.

Brown, in discussion, was of the opinion that the longer we pursue the myotics the less confidence we have in their use, and that we come to a period where the only definite means we have in hand is operative procedure of one type or another. Hawley, in discussion, is convinced that glaucoma is a symptom rather than a disease. He directs his treatment to the lower bowel. Welton thought that the problem was whether to operate or to use myotics. Hayden considers it of vital importance to eliminate focal infections and syphilis as causal factors. Tydings said that there was a physical condition in these cases that we do not know the first thing about. We ought to acknowledge it.

Peter made a study of the visual fields in glaucoma which reveals the following facts, and these facts are confirmed by clinical experience.

1. Central vision as a rule is preserved until a late stage of the disease.

2. Color fields are usually present in the central zone until concentric contraction has made great inroads upon the perimacular area.

3. Peripheral field changes are usually first observed in the upper or lower nasal quadrants and subsequently either take the form of a concentric contraction or an irregular quadrant defect which eventually becomes continuous with the blind spot of Mariotte.

4. Central defects consist of an enlargement of the blind spot of Mariotte and of arched or sickle like scotomata, which radiate from the blind spot above and below the macula; these scotomata usually begin in the peripheral field and travel toward the blind spot altho their development may progress toward the periphery and toward the blind spot.

VARIETIES OF GLAUCOMA.—**McLean** divides into 2 classes those cases of glaucoma simplex in which there are present unmistakable evidences of this disease and yet the tension remains well within normal limits. One class are those in which the lamina cribrosa stretches under a pressure that can be firmly sustained by the lamina of the average individual. The other class

are those that give history of attacks of blurred vision, halos, and uncomfortable feelings in the eye, but an interim examination with the tonometer will reveal a pressure well within the upper limit. Those are cases that present transitory increase of intraocular pressure.

Sedwick showed a case of secondary glaucoma. The patient was a woman of 59 years whose right eye was greatly inflamed. The cornea was hazy and anesthetic, the anterior chamber was shallow, the pupil occluded and the tension plus 1. At the circumference of the iris were petechial patches. The patient had suffered for 14 years from polyarthritis. All the upper teeth had been removed twenty years ago and the lower teeth 2 years ago. The right eye had been red and swollen at various times during the past twenty years. Nine months previously the patient had a severe attack, with vomiting, loss of appetite and severe pains thru the temporal region. The present attack began three weeks ago.

Stilwill presented a patient, age 40, whose vision had been failing for 3 years, but was now entirely lost. The patient had halos. The eye was divergent. The pupil measured 3 mm. but did not react to light, but did consensually. The tension was normal, the cornea clear and not anesthetic. The disc was depressed 7 D. The disc margins were not undermined. Jackson in discussion thought that in the absence of increased tension and in view of the appearance of the disc which has no deep overhanging edges, it seems likely that the atrophy is not due to pressure, but a cavernous degeneration in the head of the optic nerve.

Rutherford reported a case of spontaneous rupture of a glaucomatous eye. The patient was a woman who travelled about, a pauper. Five years before her right eye was injured with a splinter of glass from a broken bottle; it became blind, probably from chronic glaucoma, and she began to be subject to severe but intermittent headaches, worse especially in the right supraorbital region.

The day before the eyeball burst, her headache became especially severe, it continued over night and next day. At 6 P. M. the second day the cornea suddenly gave way, the eye discharging first a jet of watery fluid and then a steady trickle of blood. The instant of the rupture, which was spontaneous and not caused by vomiting or coughing, there was a great accession of pain over the forehead, and she at once began to vomit without effort, and in sudden quantities of clear watery material. There was entire absence of the profuse hemorrhage stated to occur in rupture of glaucomatous eyes.

Bilateral glaucoma secondary to congenital luxation of the crystalline lens is reported by **Foxonet.** The patient belonged to a family in which ectopia lentis was hereditary. After the age of fifty years first the left and then the right eye became affected with acute glaucoma. Extraction of the lens in its capsule gave relief and improved vision in both. **Abelsdorff** reports iritis and glaucoma and **Menacho** reports operation for glaucoma with iritis.

Fuchs has reported the conditions found in the eyes of a highly myopic woman of 69, who had suffered from glaucoma. There was abrupt excavation of the optic disc and also of the neighboring sclera, produced by the intraocular tension.

Goldenburg's paper on a glaucoma question is a statement of a theory that the congestive types and chronic glaucoma are different manifestations of the same disease; and that the clinical differences are caused by the degrees of the exciting cause.

Thomson records the anatomic examination of an eye which had suffered from acute inflammatory glaucoma. The patient was aged 70 years, had suffered from the glaucoma for six months and died from pneumonia fifteen days after being seen by the author.

Rush reported a case of chronic glaucoma, and the report is accompanied with charts of the visual field showing the result of treatment. The interesting fact in the case was that

the glaucoma was in a myopic patient.

HYDROPHTHALMOS.—In a case of hydrophthalmos reported by **Cousin** the condition attracted attention when the patient was fifteen years old. She was clearly suffering from hereditary syphilis. **Poulard** reports a case of infantile glaucoma in a child of six months. Sclerectomy gave vision of R. 4/10; L. 3/10. **Elschnig** considers the question of hydrophthalmos in an interesting article with a bibliography.

TREATMENT.—**Shahan** and **Post** have been investigating the application of *heat* by means of an electric thermaphore in the treatment of glaucoma. They have used the eyes of rabbits and those of patients with glaucoma in their experiments. The heat is applied to the sclerocorneal margin of the eye by means of brass conducting rods. Their results are interesting. However, they state that the technic is not sufficiently finished, and their experience does not extend over a long enough time for them to offer this as a better method than the usual medicinal and operative procedures at our disposal. McReynolds, in discussion, suggested that the number of cases reported is not sufficient to warrant a positive conclusion as to the therapeutic value of the measures proposed, but they are sufficiently safe and encouraging to lead to a continuation of efforts in this important field.

The excellent results from the treatment of myoma of the uterus and its accompanying hemorrhages and of the painful hemorrhagic metropathia with *Roentgen rays* gave to **Hessberg** the incentive to try them on *hemorrhagic glaucoma*, but only in eyes which were practically blind. He reports five cases. In four cases the hemorrhage and pain completely subsided and did not return. The intraocular tension was diminished in all. Whether this is absolutely necessary for the relief of pain is doubtful because the pain generally ceased after the first radiation. Nothing of the kind was observed in Hessberg's cases. To avoid complications the treatment should be carried out only by an experienced Roentgenologist. The advantages of retaining the natural, altho blind eye without pain are so great that in all cases of hemorrhagic glaucoma the application of the Roentgen rays ought to be tried. If not successful enucleation remains as an ultimate refuge.

Hirschberg examined six cases of glaucoma in syphilitic persons and considers that three were favorably influenced by mercurial treatment; and the eventual treatments of all the others were instillations of eserin; iridectomy and sclerotomy. **Torres Estrada** considers the action of fibrolysin on chronic glaucoma.

Uribe-Troncoso in early treatment of glaucoma uses myotics at first with close observations, in order to proceed to a simple or combined iridectomy after the method of Lagrange; and **Marquez** writes of the antiglaucomatous iridectosclerectomy.

The following are **Köllner's** observations on the pressure reducing action of miotics in glaucoma simplex. Wessely has pointed out that there is an initial rise of pressure with the use of eserin and pilocarpin which precedes the fall in pressure, and also showed experimentally that this depended on a hyperemia. They have determined in glaucoma simplex that the pupillary contraction precedes the fall in pressure. In the inflammatory glaucomas with sluggish iris, the reverse takes place; the tension falls before the pupil contracts. He presents a number of curves in uncomplicated cases of glaucoma simplex that show the relation, after a drop of 0.5 per cent eserin solution has been instilled, between the contraction of the pupil and the fall of pressure.

In curve 6 the pupil contracted at once, but the pressure did not come down to the maximum until two hours after the instillation of eserin. Curve 7 shows in the beginning a rise of pressure of 3 to 5 mm. in the first 5 or 10 minutes after the instillation of eserin, but in glaucoma simplex this initial rise must reach higher tension, since one starts with higher pressure.

There is a definite relation between the duration of the contraction and the decrease in pressure. The minimum

duration of the contraction was 24 hours, often 2 days, usually 2½ to 3 days. The decrease in pressure lasted almost without exception the same length of time. The same results were obtained. There are exceptions to this rule, in one case pressure remained low, almost normal for several months, while contraction disappeared in a few days. The reverse takes place also, pressure rising again while pupillary contraction continued.

He mentions a new method of studying the influence of vasoconstriction on pressure, viz, the subconjunctival injection of adrenalin as used by Wessely, the effect of which is comparable to that of miotics. The method was employed on a woman, 57 years old, with glaucoma simplex, the pressure in both eyes was over 70 mm. Hg. 4 ccm. 1/20000 adrenalin was injected subconjunctivally in one eye while ½% eserin solution was instilled in the other eye. The results in the eye with the adrenalin were extreme pupillary dilatation, the pressure dropped to 45 mm., and after two days went back to 70 mm. The experiment was repeated twice with smaller doses, with similar results. The action of eserin in the other eye was much stronger; the pressure fell at once to 27 mm. and remained down 3½ days. He thinks eserin may have a vasoconstriction action. He concludes after a number of experiments that eserin reduces pressure by contracting the pupil and increasing the drainage. His article is accompanied by 20 diagrams.

Weekers, basing his treatment on the controlling action of calcium chlorid upon processes of transudation and exudation, administered this salt by mouth, or by intramuscular or intravenous injection to patients attacked by glaucoma. In many cases the medication produced no effect on the tension. In other cases the calcium chlorid seemed to influence favorably the intraocular pressure.

Kerry reported five cases of glaucoma in which he used injections of oily solution of iodin. He injected hypodermically ten to fifteen minims of a one in forty solution of iodin in Sesame oil once a week. Failing to obtain Sesame oil, almond or almost any bland fixed oil can be substituted. **Michail** writes on the therapy of glaucoma.

Brown has reported on 20 cases in whom he took the tension, fields, measured the blind spot, accepting 25 mm. Hg. as the normal upper limit of tension. He found, when the tension went above this limit, enlarged blind spots and contracted fields. Relief was afforded these patients by the use of miotics. Brown also compares his tonometer with manometer tests, and also with the McLean instrument.

Rowan concludes that some cases of glaucoma are better treated without operation, but if so what are the indications? If the general factor producing hypertension were known, something in the way of prevention might be done. If for any reason, general or otherwise, an operation seemed inadvisable, keeping the patient under eserin and strict observation seemed best. But in the presence of signs of advancing disease, early operation should be done in the majority of cases.

In discussion Critchet said that whatever the type of operation, or however skillfully done, there was a declension of vision. He would be very glad to learn what were the indications for operating and for abstaining from operation respectively. Butler said his practice was to operate when the tonometer showed the tension was raised and there were signs of functional failure. Maghy spoke of the tendency to the formation of pigmenting adhesions between the iris and lens capsule, with diminished transparency following the prolonged use of eserin. Batten said that the cupping of the disc was the disease, the cupping was progressive whether or not the tension was relieved.

Cross in discussion of Rowan's paper thought that if central vision was good, with great narrowing of the fields, especially towards the fixation point, and an absence of inflammatory symptoms, one could safely rely on miotics.

Collins said that if the symptoms mentioned by Cross increased, he advised operation. But such factors as the age of the patient and his expectation of life, and his blood pressure must be taken into consideration. Cruise thought that the number of cases in whom the drops were beneficial must be small in comparison with those in which the results were deplorable.

Thompson considers that alteration in the visual fields was a surer sign of the condition of a case of glaucoma than the tension which might vary several times in the day. Greene was of the opinion that the physician should find a drug that would control the secretion of the ciliary glands. Cridland thought that most ophthalmic surgeons did not favor iridectomy in chronic glaucoma, and especially in those cases in which the field is contracted and involved the fixation point. Story did the trephine operation almost exclusively.

Operative Treatment.— **Weeks** gives his opinion on the operative procedures best suited to the different forms of glaucoma.

For *buphthalmos*, principal form of congenital glaucoma, he selects the scleral trephine operation for the following reasons. On account of the almost total closure of the filtration angle and the necessity of a filtering cicatrix, a large opening in the thin and elastic sclera is dangerous to the integrity of the globe, and the trephine opening can be satisfactorily covered with conjunctiva. On account of the thinness of the fibrous coat and the likelihood of some enlargement of the opening, due to stretching of the sclera, he recommends that the trephine should not be larger than 1.5 mm., and if the iris presents, a piece as liberal as can be easily secured should be excised.

How does *iridectomy* do good in glaucoma? 1. In the early stage of glaucoma iridectomy, by the removal of the iris and traction on the remaining iris, opens up the iris angle and permits of the free escape of fluid from the eye. 2. By excising the iris tissue, additional lymph spaces in the iris are opened and aqueous humor finds more ready exit thru the lymph channels and veins of the iris than occurred previous to the iridectomy. Because of these things, iridectomy can be employed to the best advantage in the early stage of noncongestive glaucoma, or before the sclerosing process has advanced to any great degree, and before the iris has become adherent at the iris angle and has begun to atrophy.

When are we to select an operation that contemplates the establishment of a filtering cicatrix? The answer to this question is that such an operation should be selected as soon as the lymph spaces at the filtration angle and in iris tissue are permanently closed to the extent that removal of iris tissue cannot restore a normal balance between the inflow and outflow of intraocular fluids. When this period is reached it is difficult to know, but it is better to err on the safe side and choose an operation for the establishment of a filtering cicatrix earlier than is necessary. Weeks' choice of operation is either the Elliot trephine or the Lagrange operation.

Secondary Glaucoma.— In Weeks' practice, he encountered secondary glaucoma in about 4% of the cases of cataract extraction. In some of these cases the capsule of the lens appears to be the cause. If the anterior chamber is opened at a suitable place and the columns of the coloboma on the incarcerated side are freely divided, the hypertension will be relieved in the majority of such cases.

Sclerocorneal Trephining.—**Hambresin** has practiced the Elliot trephine operation forty times. In his statistics he includes only those cases which he has been able to follow up for a year. In simple glaucoma 55% cures resulted. In chronic inflammatory glaucoma six cases out of seven were cured. The advantages of the trephine operation in acute glaucoma are: It can be done under local anesthesia. It is not dangerous, and can be carried out when the anterior chamber is shallow and the pupil dilated to the maxi-

mum. The postoperative astigmatism is reduced to the minimum.

Colombo gives the results of his experimental work in which he trephined a number of rabbits' eyes and after excision later examined them microscopically. The most important point, found in practically all the specimens, was that the ciliary body had been dragged forward and was implicated in the scar. Clinically there was no evidence of this to be seen after careful examination. He points out that in Elliot's operation the conditions favor the involvement of the uveal tissue in the wound, owing to the long period during which the anterior chamber remains empty. He holds that a socalled filtering cicatrix does not occur in the absence of uveal tissue.

Lieberman thinks trephining is indicated in those cases where iridectomy is not suitable because the iris angle is not affected, and in those cases of advanced glaucoma, where the angle is so obliterated that iridectomy cannot be expected to free it, or an attempt with it has failed. It must be remembered that there are cases of "malignant" glaucoma which do not respond to either iridectomy or trephining. Then there are cases of chronic and absolute glaucoma with atrophic irides, where the danger of infection thru incarceration of the iris is present, altho the writer saw no case of late infection in 200 cases trephined. In judging the value of trephining as compared to other operations, similar cases should be compared, also similar stages. Material from different operators cannot be compared justly, as not every operator is equally skillful in this operation.

Brown reported a case of glaucoma on which he performed the trephine operation with the restoration of tension to 15, and with satisfactory fields; and vision of 6/10. Within 33 months altho the tension did not rise, the eye became practically blind thru a glaucomatous process.

Guiral declares his confidence in the Elliot method of treating glaucoma. He recently had to apply it to six persons under 20, belonging to two families in which the parents and grandparents gave the history of glaucoma. The young people had simple glaucoma, and the decline of vision was arrested by the trephine operation.

Hegner concludes from a series of 40 cases operated by the Elliot method that it is superior to other intervention. In 19 cases, or 47% per cent, tension was permanently reduced with good vision. **Beckert** and **Cantonnet** also write on the Elliot trephining operation.

Marbaix claims that Lagrange was the inventor of the method of treating glaucoma by means of a filtrating scar, and that Elliot's method, altho better known, is only a modification, and one which does not give better satisfaction. He describes some of his cases and notes the points necessary to make the operation a success.

Brown tried, on a case of chronic glaucoma, Purtscher's double trephining. A large conjunctival flap was made, the cornea grooved some 2 or 3 mm. above and a 3 mm. von Hippel trephine put in position with the intention of cutting thru the outer half of the sclera and only that part lying under the upper circumference of the cutting edge of the trephine. A disc of outer layers of the sclera was then dissected away from the inner half of the sclera but was left attached on the side nearest the cornea, and this attachment acted as a hinge for the scleral flap. It was then held aside and a 1.5 mm. hole trephined thru the remaining inner layers of the sclerocorneal tunic with an ordinary instrument. An iridectomy was then done and the hinged outer half disc of sclera allowed to go back and the conjunctiva replaced. Healing had been uneventful but the eye was still red and had a high tension.

Macleod showed a case of trephining for glaucoma with a conjunctival flap implanted on the cornea. The cornea was denuded along the upper border to a depth of 2 to 3 mm. except around the location of the trephine hole. The conjunctiva was cut at the corneal margin and undermined for

⅓ the circumference of the cornea. Stitches were inserted in the flap and thru the corneal margin; after the trephine hole was made the flap was pulled up over the hole and the stitches tied.

For obtaining a better and a safer covering for the trephine opening which will not be exposed to external influences, as is the thin conjunctiva, **Wiegmann** devised the following modification. A thin Graefe knife is inserted into the limbus and after contrapuncture 4 mm. distant, the superficial lamellae of the cornea and a small flap of sclera and conjunctiva, 4 mm. wide, are dissected. After lifting the flap the corneoscleral junction is trephined and the flap placed over it. In consequence of the better covering the cushion gradually becomes flat.

Butler returns to the use of the trephine in chronic glaucoma. During the years 1918 and 1919, he has trephined over 80 eyes in some 70 patients. Forty or more of these operations have been performed to relieve tension in glaucoma simplex and all have been more or less successful. Some of these patients have been observed for over two years, and others for not more than a few months. In 4 cases the first trephine was unsatisfactory, but subsequent operations were successful. By combining these operations, 48 in all, with older trephine operations, 52 in number, we get 100 trephine operations for glaucoma simplex with 23 failures, or a success percentage of 77. Three of the 23 failures were cured by a second or third operation, which gives a final result of 80% up to date. At the present time, Butler holds that trephining with a 2 mm. instrument, performed early in the disease, holds out an excellent chance for complete cure of the disease.

He believes in early operation in these cases, and outlines what he considers indications for operation. When the tension is above 40 mm. Hg. he operated at once, but when below this tension, he uses miotics for a brief period before resorting to the trephine. He is in doubt as to the permanent value of miotics in glaucoma simplex, and as their use tends to postpone operation much harm is done. As to operation in the presence of contraction of the visual fields, he believes that the more the fixation point is menaced, either by contraction of the peripheral field or by the presence of a Bjerrum scotoma, the more urgent is immediate operation. He has trephined several such cases and all were successful. The article is accompanied by a table that gives the history briefly of these 40 cases of glaucoma simplex, the tension before and after operation and the vision before and after operation, the nature of the operation and remarks.

Asmus gives the opinions of many eminent German ophthalmologists, and it is obvious that the majority now regard the trephining operation as too risky because of the liability to late infection. Axenfeld, Meller and Haab are among those who have abandoned the operation. Asmus gives an analysis of 40 cases of his own. Among these, there is one case of late infection which finally cleared up without affecting the vision. Eighty per cent were successful. He comes to the conclusion that the results of the operation are so good that we must not condemn it because of the risk of late infection. **Gorg** makes the subject of a Giessen thesis the Elliot operation for glaucoma.

Cyclodialysis. — Numerous experiences from continued observations within the last twelve years on a large material, convinced **Salus** that cyclodialysis does not occupy the place in the operative treatment of glaucoma which, compared with the more modern procedures, it deserves by its advantages. After discussion of the literature, technic, complications during operation, intraocular tension, he concludes that cyclodialysis is far superior as to preservation of vision and visual field.

With great probability, the depressing effect of cyclodialysis may be ascribed mainly to a partial atrophy of the ciliary body developing gradually under slight cyclitic phenomena,

caused chiefly by obliteration of numerous afferent arteries, perhaps also by damaging the ciliary nerves. The hypertension is removed by the decreased function of the secretory apparatus, and gives way, according to the degree and extension of atrophic changes, to a more or less intense hypotony. Salus' material shows that cyclodialysis is a rather sure and certainly the least dangerous of all effectual glaucoma operations.

He thus formulates the indications: Cyclodialysis for compensated glaucoma, eventually repetition, iridectomy for the prodromal stage. For uncompensated (inflammatory) glaucoma with increased tension; between the attacks cyclodialysis, relapses iridectomy or a sclerectomy, or this at first; with low tension between the attacks iridectomy, or sclerectomy (trephining). For hydrophthalmus trephining, for hemorrhagic glaucoma cyclodialysis, in case of failure trephining.

The recession of glaucomatous excavation is not due to change of position of the lamina cribosa; but, as shown by anatomic investigations, to edema of the supporting and connective tissues, especially of the intraocular portion of the optic nerve with subsequent proliferation produced thru hypotomy. A second element is the quality of the papillary tissue. Only if the nerve fibres are disintegrated and the connective tissue and glia are exposed, can these swell and become ophthalmoscopically visible. It never occurs in total excavations for long blind eyes, in which also the connective tissue of the disc has disappeared.

For the indications to operative treatment of glaucoma the tonometer is a valuable instrument, but the determining factor is the condition of the vision, visual field, color perception and light sense. To control the effect of pilocarpin the patient is taken to the hospital for observation. If the miotic acts unfavorably operation is recommended; iridectomy in acute glaucoma, cyclodialysis in chronic cases. Trephining is rejected on account of its danger. Cyclodialysis gives the best result in incipient glaucoma. Iridodialysis or adhesions of the pupillary region after cyclodialysis are of no evil consequences. **Heine** attributes the action of cyclodialysis to an increased outflow, not to diminished secretion, and not, as Salus thinks, to partial atrophy of the ciliary body. In the main Heine shares the above views of Salus.

Schürhoff states that during the past twelve years 437 operations have been performed for glaucoma. The methods employed were the following; cyclodialysis, 259 times; iridectomy, 155; sclerectomy (de Wecker) 20; trephining, 2; iridosclerectomy (Lagrange), 1. The last two methods were not repeated because of the unfavorable results. One trephining had no effect, the second and the single Lagrange were accompanied by loss of vitreous, followed by infection and the eyes were removed. It was constantly noted that when iridectomy failed single or repeated cyclodialysis succeeded, but that when cyclodialysis did not reduce the tension, iridectomy was equally ineffective. The author concludes that cyclodialysis is at least as efficient as iridectomy; altho cyclodialysis would rarely be chosen in acute glaucoma of recent date. The figures give no indication of the comparative value of cyclodialysis and of modern sclerectomy operation in simple glaucoma, as trephining, was abandoned after two operations.

Cremer performed cyclodialysis on 11 eyes affected with compensated glaucoma without exception with absolutely good results. Seven cases are reported in detail. In all cases the functions remained unaltered for six years from the day of operation. Only in one case a repetition of cyclodialysis was necessary after two years; and now, after four years the condition has not been impaired. Cremer considers cyclodialysis in all stages of compensated glaucoma as the strictly indicated method. **Meyer** makes the subject of his Kiel thesis cyclodialysis in seventy-eight cases.

IRIDECTOMY.—**Gilbert** is of the opinion that iridectomy is still the chief glaucoma operation. He discusses three

points which are of value in deciding between the operative and conservative treatment.

Operation with reference to age. The author thinks that cases of glaucoma simplex over sixty years of age should not be submitted to operation. He operates under sixty because the high pressure will have longer to act upon the eye and will injure it.

Operation with reference to the vascular system. Gilbert thinks that it is a good thing to bleed patients before operation, and he is supported by Dyes, Elschnig and Kuhnt. A history of slight hemiplegic attacks should warn against operation and suggest miotic treatment. Small retinal hemorrhages, arterial sclerosis, and albuminuria are all indications for miotics rather than operation. Gilbert has seen the field contract to the fixation spot after both large and small iridectomies.

Crisp reported a case of glaucoma in a woman 33 years of age. The left eye was blind from a previous attack of glaucoma. The tension in the right eye, when she first came under Crisp's observation, was 57 mm. Hg. and vision almost 5/5. The patient was put on eserin and the tension varied between 37 mm. and 40 mm. during the following 7 or 8 days. Iridectomy was done; and after removal of the dressing, a moderate hemorrhage was found in the vitreous a little behind the lens almost completely cutting off the vision of the right eye. About 5 weeks after the operation, the vision of this eye was 1/60, two weeks later 1/20, and rather more than two months after the operation 5/12 plus, with correction of 8 diopters of hyperopia. A week later a cataract developed in the right eye and the vision fell to 1/60, the tension was 24 mm. Extraction was done and two subsequent operations were necessary on account of a tough secondary membrane. The result was excellent; the vision at the time of this report was 5/4 partly, tension about 20 mm.

Koster discusses the operation of cases of glaucoma simplex with contracted field. He has never refrained from operative intervention because the fields were contracted close to the fixation point. Some oculists have refrained from operating these cases on empiric grounds. When the operation was performed and the results were bad, they attributed the bad results to the conditions of the fields, whereas Koster thinks that the bad results are due to vascular changes resulting from the opening of the eyeball.

He retains his faith in iridectomy as the operation of choice in preference to the Elliot trephine operation. He had collected from his clinic, from the years 1896 to 1918, 22 cases of glaucoma simplex on which he had performed iridectomy with 77 per cent improved. These results he considers satisfactory.

Santos Fernandez considers iridectomy the ideal treatment of glaucoma. In spite of all that has been done for the treatment of glaucoma we are still far from a satisfactory treatment for every case. The work of Sichel and Desmarres was well utilized by von Graefe, and in our day the operations of Elliot and Lagrange have given excellent results in many cases. But the author after having treated many cases of glaucoma by different methods has gone back to the old iridectomy that in his opinion is the most efficient treatment for all acute cases.

Iridectomy is **Abadies'** choice in secondary glaucoma, and when this does not reduce the tension he resorts to trephining; and **Menacho** reports on the efficacy of iridectomy in the prevention of glaucoma. **Purtscher** reports iridectomy in glaucoma with scleral trephining, and **Sulzer** favors iridectomy in the treatment of glaucoma.

SCLERECTOMY. — **Lagrange** in performing his operation, for fistulization of the anterior chamber into the subconjuctival tissue, selects the scleral ring as the location for operation. At the limbus, we find a sclerocorneal ring 1.75 mm. wide if we measure from the zone of detachable conjunctival to the summit of the angle of filtration. This ring should be divided into two zones, a sclerocorneal zone and a scleral zone. This latter has a width of one milli-

meter, and it is in this that the exercise should be practised.

There are three reasons for restricting the scleral resections to this zone. 1. This tissue is fixed in its form and not disposed to proliferate. 2. It is just over the filtration zone. 3. One avoids wounding the cornea, which might choke the orifice with its granulations, and respects the ciliary body which reacts violently when irritated. A piece of this ring, one millimeter in width and two or three millimeters in length, should be resected with scissors, Graefe knife and punch; the trephine should not be used, as its action cannot be confined to the scleral band, and it is apt to slip over to the ciliary body or the cornea.

Herbert, in discussing his small flap sclerotomy, which operation was described in 1910, says to count as a perfect result, not only must there be a lasting reduction of tension to normal, but the filtration must be thru uniformly grey scar lines, without any trace of fistulous openings. His experience has shown perfect filtration to be assured from even moderately well performed operations in all mild untreated glaucomas, also in eyes which had been under treatment by miotics, but in which the treatment was becoming ineffectual. The failures have occured in the more advanced glaucomas with considerable tension, tho in such eyes there have been also many excellent results. It may be a sound rule to utilize rectangular flap sclerotomy only where eserin acts well and only after preparatory miotic treatment lasting two to six weeks.

Elliot's communication on small flap sclerotomy is a discussion of statements made in Herbert's paper on the same topic, and a defense of his own teaching and operation.

Young's paper on double sclerectomy is a review of this operation. His chief reason for performing the operation on the lowest segment was that it left the upper segment free for future operation if the first failed. The second reason was it was easier to operate in this location if the patient was under a general anesthetic. The lower segment might promote drainage. Experience had taught that the trephine opening should be close to the sclerocorneal margin but not to open the anterior chamber. A 1 mm. trephine was large enough. **Van Duyse** writes on the permeability of the scar after sclerectomy for simple glaucoma.

Foroni has described what he calls sclerectomy from the outside. After separating the conjunctiva up to the limbus a Graefe knife is made to cut from without inwards to the vertical meridian; until it enters the anterior chamber. A small hernia of the iris occurs which is excised. Then a portion of the sclera is removed by scissors. The conjunctival opening is closed by sutures. **Aubaret** writes on sclerectomy in glaucoma.

Late Infection.—**Zeddik** reports two cases of late infection following the trephine operation, one case developed 6 months after the operation. He remarks that in this case the trephine hole was downward and insufficiently covered and protected by the lower lid, and lying in the neighborhood of the lower cul de sac, to which any discharge in the eye naturally gravitates.

Case 2, of a woman aged 50, who had been operated upon by a well-known oculist 4 years before, was observed. The lids of the right eye were edematous, conjunctiva chemosed, trephine hole up, with yellowish pus under the bleb; cornea nebulous aqueous turbid; and small hypopyon. The bleb was incised and the pus contained abundant Morax-Axenfeld bacilli. The patient was suffering from ozena and a smear from the nose revealed the same microorganisms. This case is interesting and illustrated the fact that infection can occur as late as 4 years after a trephine operation, and that the nose may play a large part in its causation. Eddin, in discussion, reported a case of late infection which appeared to follow the hard rubbing of the eye. Sobhy states in discussion among causes of late infection that the microorganisms can pass into the globe thru cystoid cicatrices.

A case of late infection after Elliot's

trephining is reported by **Wissman.** About six years had elapsed since the original operation. Under treatment including specially optochin and covering the trephine opening with a conjunctival flap the eye became free from inflammation. Records of some 30 cases of late infection are brought together and the importance of preventing or treating such infection with optochin is dwelt upon.

A case of trephining followed after four months by detachment of the retina is reported by **Maschler.**

VARIOUS OPERATIONS.—The late results of corneo-scleral trephining in 38 cases are reported by **Bauté.** In 25 cases of chronic simple glaucoma, 34 eyes, vision was improved in 13, remained stationary in 8, and in 13 continued to decline; in 6 without appreciable cause and in 7 with increasing lens opacities. Among 7 chronic irritating glaucomas one improved, 2 remained stationary, 4 grew worse with increasing cataract. In four secondary glaucomas 2 improved, 1 remained the same and in 1 vision diminished. In 3 cases of acute glaucoma vision improved in all. It is concluded that the Elliot trephining is the operation of preference for all cases of chronic simple glaucoma.

Grosz performed 1,152 operations for glaucoma in the years 1913 to 1919 at the University Eye Clinic at Budapest. Elliot's operation was performed 401 times. For chronic inflammatory glaucoma 163 times. For absolute glaucoma 139 times. For glaucoma simplex 99 times. Late infection was infrequent. One patient developed sympathetic ophthalmitis but the eye was saved. In 29 cases of glaucoma simplex which were examined after some time, 10 showed diminished acuity, 38 per cent. Chorodial hemorrhage was rare, but posterior synechiae frequent. Twenty per cent of subacute cases showed loss of visual acuity. Iridectomy will in the future be the general operation, and the earlier the case the more suitable is it for this operation. Chronic inflammatory glaucoma with clear media and contracted field may be trephined. In glaucoma simplex trephining will no longer be performed but Lagrange's sclerectomy. Sclerectomy is the correct procedure in early stages of juvenile glaucoma. In advanced cases no operation is of any avail. Enucleation is best in absolute glaucoma.

Herbert's improved iris prolapse operation for glaucoma is performed as follows. A subconjunctival sclerocorneal incision about 6 mm. long is made above, close to the limbus with a 1 mm. Graefe knife. The only conjunctival puncture is 3 mm. away from the limbus and horizontal to it; from this point the conjunctiva is slid on the point of the knife. The puncture is enlarged a little when withdrawing the knife. The wounding of the conjunctiva at the counterpuncture is avoided by beginning short sawing movements as soon as the point of the knife is seen perforating the sclera. Thru this section, a wide fold of iris is drawn up under the conjunctiva by the use of fine straight iris forceps, where it is transfixed and incised by the same narrow knife cutting upward. Atropin is instilled at once, two or three times and repeated several times daily, mainly to prevent displacement of the pupil upward.

The disadvantages of this procedure are: A greater amount of astigmatism results than in classical iridectomy. A recurrence of plus tension, resisting eserin or massage, has required a repetition of the operation two or three times before the tension has remained down. More or less unsightly bulging of the prolapse. The advantages are: Lasting hypotony is never produced. Comparative security from risk of disaster of vascular origin in operating in advanced chronic glaucoma. Safety from infection, early and late.

Curran states that his operation differs from all others in the fact that it is an attempt to drain from the posterior chamber into the anterior chamber. It is not only a difference in procedure but a difference in principle. A Knapp knife needle is passed thru the sclerocorneal junction at the upper and temporal border into the anterior chamber, the point of the knife needle

is dipped downward to engage the iris, and cut thru it either singly or by making a counterpuncture, thus establishing a route for the aqueous from the anterior to the posterior chamber. The percentage of apparent cures based on operation of 49 eyes including all types, is approximately 94. He reports results in 15 cases and illustrates the operation by 8 cuts.

Maghy reported on 100 cases of primary acute congestive and subacute glaucoma, treated at the Royal London Ophthalmic Hospital in 4 years. Aside from the operation, the treatment was the same for each case. Oily solution of eserin, 1 per cent was used three days during the first day, followed by ½ per cent aqueous solution three times a day. Aspirin was occasionally given, morphin seldom for pain. In all trephined cases the Lang instrument was used; in most cases, the conjunctival flap had one black silk stitch. Following the operation ¼ per cent atropin solution was instilled in the operated eye in some cases, and in others it was not used until the second day.

The right eye was involved in 48, and the left in 55 cases. There were 24 males and 63 females. As to age, one case was 25, 2 were 31, 20 were between 40 and 50, 21 between 50 and 60, 37 between 60 and 70, 14 between 70 and 80, and one between 80 and 90 years.

Influenza was present or preceded the attack in 4 cases, rheumatism in 4 cases and 3 cases had pyorrhea. In 2 there was a history of injury before the attack set in. Acute congestive glaucoma was present in 69 cases, and subacute in the balance. Of 63 iridectomies, the iris pillars were drawn up to the wound in 4 cases. In the 35 trephined cases the disc fell into the anterior chamber in one, without causing symptoms of iridocyclitis.

Wilder in discussion states that a safe working rule might be to rely on the miotic treatment, only as long as it kept the intraocular pressure down to the normal, as indicated by the tonometer, and as long as the central and peripheral vision were maintained and the blind spot of Mariotte showed no marked increase. Dodd in discussion gave the history of two cases which he had trephined, the tension came down to normal, but the vision decreased and the condition was apparently growing worse. Examination showed in each case infected teeth. When the infection was cleared up, the vision returned to practically normal. Tydings thought when a blurred disc, vomiting, detached retina, retinal hemorrhage existed in connection with glaucoma, they were undoubtedly due to other factors than glaucoma per se.

Lane said, in discussion, the anatomic explanation for the permanent contraction of the field was a degeneration of the more anterior ganglion cells of the retina. The peripheral cells appeared to possess less power of resistance to pressure and consequently were the first to degenerate. He had observed vacuoles in these cells at this location, which did not differ in appearance from those described following optic neuritis. All fibers of the optic nerve had ganglionic cell attachments in both the retina and the brain; so if in glaucoma the primary lesion lay in the ganglionic cells of the retina the changes in the nerve must be regarded as ascending atrophy. Optic nerve fibers did not follow the Wallerian law because they had two centers.

The enlargement of the blind spot in glaucoma must also be explained on anatomic grounds. The lamina vitrea was the only structure of the retina and choroid which touched the optic nerve fibers. If glaucomatous excavation was present it could well be understood how this membrane could be subjected to traction or wrinkling at its border, thereby causing an anatomic disturbance of relationship of the rods and cones in the immediate vicinity, which would account for the increase in size of the blind spot.

Gradle in discussion thought that retarded outflow could be estimated by massage. Following two minutes of deep massage the normal eye was reduced in tension about 8 or 9 mm. Hg.

If the reduction in tension was less than 4 mm., it might be said that the outlets of normal circulation were so blocked that a restoration to normal conditions could not be produced by miotics alone. Goldenburg in discussion thought that the same conditions which produced arteriosclerosis, had some relation to the production of glaucoma. The fact that every glaucomatous eye, that came under the microscope, disclosed an infiltration into the spaces of Fontana, the root of the iris and frequently adhesions of the iris to the cornea, cutting off drainage, was very significant.

Crystalline Lens

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DIGEST OF THE LITERATURE.

EMBRYOLOGY AND DEVELOPMENT.—**Uhlenhuth** showed that after extraction of the lens, there is a proliferation of the cells of the epithelial part of the iris border, after they have been brought to depigmentation. The proliferation is then confined to the upper iris border. The author studied the steps from the extirpation of the lens to the beginning of the general cell proliferation. Cells and fragments of the iris of Rana pipiens were examined in fluid and solid media after Carrel's method. It was found that the pigment cells of the tapetum and the iris partially lose their pigment as soon as they are brought into fluid media. The iris of the salamander, on its external and internal sides, near the basal membrane, is surrounded like a sack, by a connective tissue membrane, by which it is protected from the aqueous. When the lens is removed, a hole is formed at the pupillary border thru which the aqueous can come in contact with the iris pigment cells, which then extrude their pigment. This hole is later filled by connective tissue, and the depigmentation ceases. By this depigmentation, the cells lying at the pupillary border regain their power of dividing.

Kolmer found in the eye of a silurus, a second lens about one-half the size of the other. It lay on the retinal layer of the iris, from which it was separated by a homogeneous layer, closely resembling the anterior lens capsule. Under this were found flat epithelial cells, structures similar to the inner lens fibers, arranged as in an embryonal lens. Nuclei were not visible. An irregular band was attached to these fibers. The peripheral part of the mass showed a hyalin degeneration. Zonular fibers passed from the secondary to the primary lens.

ANATOMY AND STRUCTURE.—**Meyer** used a corneal microscope with the Gullstrand lamp and in his investigations describes ten surfaces of the lens.

1. Anterior capsule markings (found in all cases.)

2. Anterior limiting surface, distinctly present only in the young.

3. Anterior nuclear striae of adolescence, always found at the age of twelve years and becoming more pronounced with age.

4. Peripheral anterior embryonal nuclear striae, irregularly formed, inconstant, small, diffusely bordered, greenish in color.

5-6. Central anterior and posterior embryonal nuclear striae.

7. Peripheral posterior embryonal nuclear striae, similar to 4.

8. Posterior nuclear striae of adolescence similar to 3.

9. Posterior limiting surface, difficult to see, present in about 1/5 of cases.

10. Posterior capsule markings, corresponding to 1, but more yellow.

ANOMALIES OF LENS, COLOBOMA, LENTICONUS.—After reviewing the literature, **Meisner** reports two cases of coloboma of the lens and of the zone of Zinn in which iridectomy had been done in early childhood for infantile glaucoma.

Thompson reported a case of bilateral senile cataract in combination with congenital coloboma of each iris in a woman of forty-eight. No history of congenital anomalies in the family. Right vision: 20/200 and left vision fingers at three feet. (See p. 187.)

CONGENITAL DISLOCATION.— **Fuchs** reports a case of injury in an 11 year old boy, whose eye was removed. On inspection, it was found that the ciliary processes extended abnormally in a posterior direction and showed besides their normal epithelium, a second, partly pigmented epithelial layer. The crystalline lens was dislocated posteriorly and presented two different cataracts: one in the posterior cortical layer, consisting of disintegrated lens fibers and caused by trauma, and a lamellar cataract, parallel to the capsule, which probably was present before. There was a total detachment of the retina. The most remarkable change was a proliferation of the ciliary epithelium. This proliferation started anteriorly, where the retina had been torn off, and from that part of the pars ciliaris retinae which still was in connection with the ciliary body. This anterior proliferation covered the ciliary body, the iris and peripheral parts of the cornea. It rested immediately on these structures except at the anterior surface of the iris and at the cornea where it was separated by a thin layer of connective tissue. There was also a posterior proliferation of ciliary epithelium which originated at the line of rupture on the detached retina and extended over the anterior surface of the lens without the interposition of connective tissue. The proliferating epithelium, partly pigmented, partly unpigmented, was low cuboidal and cylindrical in shape and had round or longitudinal nuclei. The cell borders were barely visible. It had proliferated mostly in a single layer. There were, however, several circumscribed areas where it was arranged in multiple layers. As a rule a heavy trauma is required to produce such a detachment of the retina with dislocation of the crystalline lens. The trauma in the reported case was relatively slight but a rather firm condition of the anterior parts of the vitreous humor may have constituted a predisposition. The author believes that such a condition existed in view of the dislocation of the lens. The dislocation, in his opinion, was congenital, as a congenital dislocation was found on the uninjured eye. The peculiar posterior direction of the ciliary processes is often connected with a dislocated lens. Three cases are cited. The proliferation of the ciliary epithelium must be ascribed to the trauma. It is rather frequent in ectatic bulbi and starts then from the surface of an uninjured epithelial layer. In the reported case, it originated from the line of rupture of the retina. As this is very unusual, the author looks for an unknown stimulating factor in the congenital anomalies of the eye.

Hansell reports a double extraction of dislocated lenses with corrected vision in each eye of 6/5. The patient's father and mother were first cousins and the children of twin sisters. There were eight children who, after reaching the age of 35, had defective sight.

Kraemer reports a case of both lenses dislocated downward and inward, inclined backwards, and so rotated about their vertical axes that the posterior surfaces looked outwards and upwards. Good vision was secured with strong plus lenses, as the entire pupillary areas were aphakic.

Clark reported cases of dislocation of the crystalline lens. In the congenital cases he refracted the aphakic portion of the eye and gave the patients useful vision. In the traumatic form the author either does an intracapsular extraction or removes the lens after transfixing it by the method described by Agnew.

In a second paper Clark discussed coloboma and congenital dislocation of the lens and reports two cases. A chart of a family, in which are several cases of coloboma and dislocation of the lens, is given.

A woman 26 years of age with congenitally dislocated lenses was shown by **D'Ombrain.** The right lens was opaque from a nearly mature cataract. The left was dislocated into the anterior chamber. The left eye was red and painful but the tension was normal, and the discomfort was relieved by atropin. In extracting a subluxated lens **Susini** employs a hook, following the technic of Rollet.

ACQUIRED DISLOCATION.—**Agatston** presented a case of dislocated lens into the vitreous, the result of direct violence. The case was complicated with a large vitreous hemorrhage which subsequently cleared up. Within a few days, the lens became completely dislocated and was found in the bottom of the vitreous. Tension was not elevated. **Cabannes** and **Montoux** report luxation of the crysalline lens into the vitreous.

CONGENITAL CATARACT.—**Vogt** says that an anterior axial embryonal cataract is easily detected with the slit lamp. Its appearance remains the same from early childhood to advanced age. It is constantly found in the centre of the second anterior embryonal Y-suture, anterior to the "central interval." It shows an intensive white color and consists of areas of small white points and dustlike opacities which are surrounded by a whitish areola. This embryonal cataract is so small that it does not usually interfere with good vision. 111 persons, ranging in age from 4-70 years, with normal eyes or different pathologic conditions on one or the other eye, were examined and this cataract was found in about 25 per cent of all eyes. It was also observed in the eyes of a two months old child. The genesis of the anterior embryonal cataract goes back to early stages of embryonal development, either to the time of obliteration of the "lentic vesicle" or to the time when the anterior lens fibers arrange themselves to the anterior suture. It is also possible that these opacities take their origin at different stages of development. Similar opacities were also observed in different domestic animals.

Santos-Fernandez believes that congenital cataract has a tendency to reabsorption, with a little help. He condemns the extraction treatment of these cases and invariably makes use of the needling operation. Cataract, in children, must surely have a different etiology than in old people and therefore the treatment has to be totally different. The author mentions several cases of spontaneous reabsorption of traumatic cataract in young persons, but when after waiting some time, absorption has not taken place, he employs the needling, repeated once or twice if necessary.

Post reports a case of congenital cataract occurring in a patient 23 years old upon whom a discission was done with a satisfactory surgical result; but with no improvement in corrected vision because of the presence of a partial central scotoma. Review of the literature revealed there was a great diversity of opinion, altho the weight of opinion seemed to favor early operation. The author concludes that operation should be undertaken as early as practicable, preferably about the eighth year, in order to lessen the possibility of retinal deterioration, to facilitate the operative procedure, to reduce to a minimum the danger due to anxiety neurosis, and to assist the child to grow up under as nearly normal conditions as possible.

Schwenk favors early operative interference in order to retain retinal function and cited cases where delayed operations caused amblyopia due to failure of early retinal stimulation. He prefers curettement of the lens thru a small opening into the upper part of the cornea with a broad needle. The general discussion brought out the fact that all agreed upon early operation, altho the majority preferred discission.

Blanco enumerates the cases of delayed union of the wound following cataract extraction, and discusses the treatment of this complication. When confronted with retarded healing, the author first removes all covering from the eye and applies tinctur of iodin to the wound, after anesthetising the eye with cocain. If this treatment fails, he scrapes the epithelium from the margin of the wound and covers the area with a conjunctival flap.

Cassimatis reported a case of bilateral congenital zonular cataracts. There was a history of cataract and eye affections in other members of the family. The author enumerates the theories which have been advanced as a cause of this condition.

Alonso classifies the various types of

congenital cataract, and discusses the surgical treatment of each variety; and **Crawford** discusses the symptoms and treatment of congenital cataract. **Aubaret** and **Ourgaud,** and also **Baldino** write on congenital family cataract and syphilis. **Hauss** reports the cases of lamellar cataract seen in the Heidelberg clinic between 1910 and 1915.

Two of the 36 cases were not operated. In one case detachment of the retina was observed after the vitreous humor had been injured during discission. Discissions and iridectomies, each alone or both combined, with or without extraction of the lens were made. The vision varied from less than 1/3 to more than 1 in 33 discissions.

Hereditary and Familial Cataract. —**Rowan** and **Wilson** report a family in which cataract came on between the ages of 13 and 18 years, previous to which time vision was good. Corrected vision after operation was good. Both eyes were unusually affected in the cases seen by the observers and presented a clinical appearance of ordinary senile cataract. A geneologic tree is appended which shows five cataracts out of eight children in the first generation, seven out of twenty-four in the second generation and six out of twelve in the third.

Pathogenesis of Cataract.—**Van der Hoeve** (See v. 16, p. 139) after reviewing the observations made by the author and others and setting forth the arguments that have been published bearing upon the ultraviolet lights upon the eyes, explains how light falling upon the lens may exert its unfavorable influence upon the ciliary processes, by the dispersion of short-wave light because the lens is optical heterogeneous. In the lens, the greatest diffusion of light takes place in the anterior part because many of the ultraviolet rays will not even reach the posterior part, therefore the greater part will reenter the anterior chamber by the pupil but another part will irradiate the posterior layer of the iris and the third part will go sideways to the ciliary processes. The author points out that these ciliary processes are attacked at their most vulnerable point where the epithelium is unprotected, thereby making possible serious damage to the structures with the subsequent formation of lenticular opacities. The author makes the suggestion that senile cataract may offer a protection from the light, thereby preventing pathologic changes in the macula. The author concludes:

1. The lens is optically heterogeneous.

2. Ultraviolet rays may seriously damage the retina and the ciliary processes as well by natural light (snow blindness) as in artificial light or in experiments.

3. Senile cataract and senile degeneration of the macula exclude each other in a certain measure: if one of those affections is present the other is absent or less developed.

It is probable that:

1. The damage to the ciliary processes by light rich in ultraviolet rays is caused by the optical heterogeneity of the lens: which disperses a part of the rays and especially the ultraviolet to the ciliary processes and in other directions.

2. A principal cause of the origin of senile cataract is the influence of light high in ultraviolet rays, such as daylight: which causes the opacity by interfering with the nutrition of the lens, in damaging the ciliary processes by rays dispersed against their epithelium.

3. One of the principal causes for the the appearance of senile macular degeneration is the influence of light rich in ultraviolet rays which has passed the lens.

Vogt reviewing information gained relative to structure and course of senile cataract with the Gullstrand light, emphasizes that there is an essential difference between the findings in old age and those resulting from exogenous disease. Natural senile changes are as much a mystery as life itself and cannot be warded off. Different parts of the lens may develop senile changes independently of each other and in different degrees.

Wilkinson describes a case of double cataract in a woman of forty, with negative general and eye findings. Cor-

rected vision, 20/20 in both eyes. The only discoverable etiologic factor might be found in the fact that 2½ years prior to being seen, the face was exposed to X-ray treatment of lupus erythematosus. It was estimated she had sixty treatments in all. The eyes were not protected by filter and the patient looked at the tube during exposures.

Handmann is of the opinion that cataract begins in the deeper (supranuclear) and also in the superficial (subcapsular) zones of the cortical substance of the lens. Not all opacities are cataractous and pathologic. Punctate cataract is a disease by itself and cannot be considered as an early form of senile cataract. Heredity may be a factor only in rapidly developing senile cataract.

Special Varieties.—**Gjessing** examined 4,768 eyes in 2,411 individuals with Gullstrand's slit lamp and Zeiss's corneal microscope. His observations are in harmony with previous findings by different writers. The difference in the frequency of occurence of certain pathologic conditions is ascribed to racial differences between Swiss and Norwegians. He assumes with Vogt that the shagreen of the lens is formed of epithelium and superficial lens fibers. The yellow color of the lens, increasing with age is not due to inspissation (Vogt), but to a deposition of pigment in the nucleus of the lens.

After the forty-sixth year highly refracting, radially arranged spaces appear under the capsule which are at first clear, but later become opaque with increasing age. The cataract developing from these "water spaces" is actually that change which originally was meant by the term "senile cataract." It is frequently combined with coronary cataract, but is not related to it genetically.

Cataractous changes were seen in 716, or 29.1 per cent of all persons examined. 90 per cent of these, 716, had typical coronary cataract. This form of cataract was never directly subcapsular, but was separated from the capsule by a zone of clear corticalis. It was always present in both eyes. The frequency of occurrence increases with age. An increase in the refraction of the lens fibers was observed in these cases, probably caused by a diminution in the fluid content of the lens.

In 5 per cent of the examined persons, punctate cataract was found. This cataract is independent of the age and probably of congenital origin.

Ultraviolet rays or previous infectious diseases are of no importance in the genesis of coronary cataract. On the other hand, heredity, puberty, climacterium and especially pregnancy are predisposing factors. The color of the iris has no significance and anomalies of refraction only in so far as they lead to vitreous and chorioretinal changes, which together with uveitis favor the occurrence of coronary cataract. In patients with senile changes in the macula, however, the cataractous changes in the lens were very little pronounced. Intraocular tension is independent of cataract. There was also no connection between cataract and intestinal putrefaction.

Poulard reports upon fifty-five operations for traumatic cataract. Thirty-seven of these were the result of penetrating wounds; eighteen were the result of contusion of the globe. The visual results obtained were better in those cases which followed contusions of the globe than in those following penetrating wounds, probably because in the wounded eyes more serious damage was done to the deeper structures than in contused eyeballs. The visual results obtained following operations were very variable, one-half of the cases obtained sufficient vision to read; one fourth obtained 1/2 to 1/10 per cent; slightly less than one-fourth obtained 1/20 to 1/50 per cent. In four only, vision was unchanged. In all cases of lowered vision, choroidal lesions or cloudy vitreous were found. Usually there was no postoperative reaction. In several, iridocyclitis followed with serious iris changes. In cases of traumatic cataract, extraction should be made if the patient desires. **Pockley** reports good results after operation of traumatic cataract of 49 years.

A simple procedure for the extraction of traumatic cataract is employed by **Bourgeois.** A linear extraction is executed with a small keratome bent at an angle of forty-five degrees. The lens material is milked out with a spoon of the Daviel type. Iridectomy is unnecessary.

In traumatic cataracts following injuries to the eye by magnetic foreign bodies, **Luc** claims that the best results are obtained by first removing the foreign body with the magnet and after the inflammation has subsided extracting the cataract.

In **Cousin's** experience the prognosis in cases with traumatic cataract during the war was poor, because of infection and the presence of foreign bodies in the eye. **Park** reported a case of traumatic cataract.

LENS OPACITY FROM COPPER.—**Jess** describes eight cases of a peculiar lens opacity in connection with the presence of intraocular copper and brass fragments. The literature is reviewed and the author adds two new cases, in which the presence of copper fragments was proved. Several months after the trauma, a grey-greenish central opacity appeared behind the capsule from which opaque lines radiated towards the equator of the lens. The opacity showed all the spectral colors when illuminated from the side by diffuse light. It was visible only in reflected light and disappeared when viewed with light passing thru the pupil and lens. There were also changes in the retina. These peculiar lens opacities were observed only in younger people of 15 to 25 years of age. The color and the physical behavior indicated a connection with the intraocular copper fragments.

Rumbaur states that so far fourteen cases (three before the war), have been published of the peculiar form of cataract, due to the presence of copper in the interior of the eye. They are quoted in tabular arrangement. They show at first a central disciform opacity, which is iridescent and can be transilluminated with the ophthalmoscope. Then radial spokes develop imparting to the lens the typical sunflower appearance. Rumbaur's first case was peculiar and similar to a case of Jess: an opacity in the posterior portion of the lens, which consisted of fine curved filaments and dots. On observation with the corneal microscope and Nernst slit lamp, there was seen a shagreen of saturated metallic colors especially red, bluish green, yellow and manifold transitions.

The typical aspect led to the diagnosis of intraocular foreign body of copper in the interior. The ophthalmoscopic condition undoubtedly suggested a perforating injury by a foreign body, which according to the direction of the scar in the retina and choroid was lodged in a large atrophic focus near the ciliary body.

Purtscher describes the peculiar spectrum like shimmer seen in the crystalline lens of an eye containing copper, when oblique illumination is used in examining the eye. The author states that the change is not due to a true opacity of the lens, for it cannot be seen with the ophthalmoscope.

In the two cases of copper in the eyes seen by **Esser,** the lens changes were typical. The iridescent opacity could be seen by oblique illumination but disappeared when using the ophthalmoscope. The Purkinje image from the posterior capsule had the appearance of being tinted by the colors of the spectrum. This, the author presumes, is due to the lens fibers, which are hexagonal, acting as prisms and breaking up the light into the spectrum. Esser suggests that the lens changes might be secondary to nutritive changes due to a chorioretinitis which was caused by the copper and not directly due to the chemical action of the copper on the lens. In one of his cases the copper had been in the eye 3½ years and in the other 11 years. In **Klauber's** case copper in the vitreous produced iridescent changes in the lens.

Pichler reports four cases of iridescence on the anterior surface of the lens in the presence of copper, wood, and stone fragments. This shows that the iridescence in itself is not pathognomonic for the presence of a copper

fragment. However, in both cases in which a copper fragment was found in the interior of the eye, the iridescence was much more pronounced and showed distinctly red, green and yellow colors. The explanation of this symptom is still obscure.

Haab reports a case of trauma to the lens by a copper fragment, followed by a traumatic cataract and temporary detachment of the retina. Discission of the cataract was done.

Vossius Ring Opacity of Lens.—**Schuermann** reports a case of Vossius's circular lens opacity in a 13 year old boy in whom after a trauma, a typical temporary circular lens opacity was observed. The opacity, as examined with the corneal microscope and Gullstrand's slit lamp appeared as a deposit of fine pigment substance on the anterior surface of the lens without pathologic change of the capsule, the epithelium or the substance of the lens. At the same time coarser pigment particles were seen irregularly distributed over the anterior surface of the lens, occupying the same plane as the circular opacity.

Three days after the appearance, and independent of it, another grey opacity appeared in the substance of the lens itself. While the circular opacity had disappeared after 21 days, this second opacity in the substance of the lens persisted.

Besides the sudden increase of the intraocular pressure and the formation of an exudate, the author concludes that the traumatic dilatation of the pupils may be a factor in the production of this circular opacity, as with an intact pupillary motility that deposited pigment may be wiped off again.

Triebenstein reports three cases of Vossius's circular opacity. One of these showed no trace of a hemorrhage whatever. The author found in his cases a confirmation of Vogt's opinion that the corpuscular depositions consisted of pigment from the iris and not of blood. Triebenstein believes that an increase of intraocular pressure and exudation of an albuminous substance are causal factors in producing the condition.

After discussing the opinion of different writers, **Behmann** reports three new cases of Vossius's circular lens opacity which he examined with the Nernst slit lamp. He reaches the following conclusions:

1. The opacity corresponds to the impression of the pupillary border upon the anterior surface of the crystalline lens. The cornea is pressed backwards by the traumatizing force so that temporarily cornea, iris and lens are in close contact. A serofibrinous exudation takes place which fixates the pigment to the anterior surface of the lens in the form of a circle or a disc.

2. The opacity consists only of pigment deposits on the anterior surface of the lens without a pathologic change of capsule or cortex. Pigmented particles in the circulating fluid of the anterior chamber and on the posterior surface of the cornea were also observed.

3. The opacity may be caused not only by a force directed against the anterior globe, but also by a force coming from behind.

4. The disappearance of the opacity begins in the centre. The duration is about two weeks. A longer persistance is suspicious of an injury to the crystalline lens itself.

Pigment Cataract.—**Brueckner** reports a case in which years after an operation for a traumatic cataract a dark brown pigmented secondary cataract was observed. With the Zeiss corneal microscope grey-white rests of the lens could be recognized in which strands and irregular masses of brown pigment were deposited. Vision was considerably improved after discission.

The pigment was in all probability derived from the proliferated pigmented epithelium of the ciliary body. The cause of this proliferation is unknown.

Concurrent Conditions: **Vossius** notes that there is a connection between the function of the thyroid gland and cataract. In patients with general symptoms of thyroid disorder, the development of cataract may be ascribed to a disturbed nutrition of the lens substance, due to autointoxica-

tion. The author cites cases of myotonic dystrophy and cataract, and reviews all the cases of cataract and scleroderma reported in the literature. He adds two new cases in which, besides the lesions mentioned, there were other symptoms of endocrin disturbance such as premature grayness of the hair, underdeveloped skeletal system, microcephaly, and atrophic thyroid gland.

Schmidt calls attention to the relation of constitutional diseases and certain forms of chronic poisoning, to cataract. This relation is especially clear in myotonic dystrophy, a condition which is termed as a pluriglandular disease of endocrine glands. After reviewing the literature Schmidt reports a case of his own with subcortical cataract on both eyes and endocrine symptoms. The hereditary degenerative character of the disease was outspoken.

Koller presented a case of megalocornea upon whom he had successfully performed cataract extraction.

Morax considering senile cataract developing in chronic, subacute or acute glaucomatous patients in whom an iridectomy or sclerectoiridectomy has controlled tension, believes that operation should not be shirked if there is a reasonable prospect for improvement in vision. In choosing a time for operation, he is governed by the same operative indication as in any case of any opacification of the lens. Owing to the paucity of cases, the author urges the reporting of individual results. He quotes two cases.

1. A woman, age 61, upon whose right eye an iridectomy had been performed which controlled the intraocular tension. Later a sclerectoiridectomy was done resulting in a good filtering scar. The lens was extracted with a corrected vision of 1/10.

2. A man, age 60, upon whose eye a second sclerectoiridectomy resulted in a good filtering scar. Extraction of the lens with an incision on the side between 11 and 4 o'clock on clock dial. The filtering scar produced by the second sclerectoiridectomy disappeared altho the tension remained low. Subsequently the tension rose and the vision was lost within the year, the third sclerectoiridectomy having failed.

Complicated and Peculiar Cataracts, Black Cataract.—**Bane** presented a case of posterior *polar cataract* in a man, aged 20 years. In the left visual field was a central scotoma with floating bodies in the vitreous. **Paton** presented a case of *blue dotted cataract* with corrected vision of 6/12 and 6/9. **Arana** saw a man 72 years of age who had *black cataract*. **Janacek** reports tetany and bilateral cataract in pregnancy. **Ring** reported a case of Morgagnian cataract upon whom a preliminary iridectomy had been done. Upon attempted extraction under cocain, after completion of the usual flap, following application of the cystitome to the capsule, the patient became nervous and operation was suspended for a moment. Upon opening the lids, the entire pupillary area was perfectly black (the liquid cortex having completely extruded itself), except that the dense, hard nucleus had fallen down to the base and temporal side of the capsule and back of the outer pillar of the iris. The 5 mm. nucleus was delivered by a small loop without accident. Subsequent corrected vision was 20/30. **Torres Estrada** reports spontaneous rupture of Morgagnian cataract.

Miller reports a case of bilateral mature cataract in a woman of 79, suffering from chronic diabetes. Preliminary iridectomy was done without incident. Before the incision was finished, the zonule ruptured with an escape of fluid vitreous. Owing to this complication, only part of the lens was delivered. The pillars were replaced and the wound closed with a conjunctival flap. On the second day the wound was gaping, being filled with lenticular debris and capsular remnant. After fifteen days, the anterior chamber closed and the lens absorbed. With proper correction, the patient was able to read 1.5 near test type. **Ralston** writes on the extraction of senile cataract.

Wessely emphasizes the fact that the prognosis in cases of *diabetic* cataract

is not good. There is danger of infection of the wound and retarded healing. Frequently the retina is involved in a diabetic retinitis. **Gallus** questions as to whether there is diabetic cataract.

Lapersonne and **Velter** reported two cases of cataract in persons suffering with glycosuria. Other members of the family suffered from the same conditions. The authors were undecided as to whether the glycosuria was a familial defect and produced the cataract, or whether the cataracts were of a congenital type and the glycosuria a coincidence.

Fischer saw a case of bilateral advanced cortical cataract in a man 30 years of age. The patient was very poorly nourished and the cataract had developed rapidly. The author believed that the opacity was a manifestation of hunger edema.

DIAGNOSIS:—**Vogt** describes the most common types of senile cataract which he could examine with the slit lamp. He classifies them into the following groups:

1. "Water space" formation in the cortical zone. Transudation of myelin droplets into these spaces changes them into radially arranged opacities.
2. Coronary cataract, hereditary, rare before puberty, but in 25 per cent of all persons beyond the age of puberty; thin transparent opacities, visible only after dilatation of the pupil; in greater age often combined with other types of cataract.
3. Flat cuneiform peripheral opacities in the anterior and posterior cortex, most frequently found in the inner, lower quadrant.
4. Concentric lamellar disintegretion, usually combined with the flat peripheral opacities mentioned above. It appears as parallel lines, resembling wrinkles, which are in the majority of cases found in the lower nasal quadrant.
5. Concentric posterior cataract, usually subcapsular and leading to early extraction.
6. Diffuse and peripheral concentric granular opacities.
7. Nuclear cataract, beginning in the embryonal nucleus, transparent, the gradually disintegrating nuclear substance forming a dust like infiltration.

Senile cataract is not due to an exogenous cause, but is simply a sign of senility, just as grey hairs and a senile arch.

Uribe-Troncoso calls attention to the fact that the classifications of cataract based upon the supposition that the nucleus becomes cloudy is manifestly an error because the process of degeneration takes place only in the layers of the cortex surrounding the nucleus which in the beginning has two distinct clinical types; the opacity being formed either near the equator or directly forward or behind the nucleus in the area of the pupil. He calls attention to the fact that the only difference between the cortical cataract and nuclear cataract is the starting point of the opacity. For that reason he believes that the term cortical ought to be dropped from the language and the type of cataract beginning in the periphery, generally by opaque strokes or sectors, be called equatorial cataract. The other form, appearing in the center of the pupil as a light haze or cloudy white spots, and due to the opacity of the layers in front and especially behind the nucleus, should be called paranuclear cataract. He calls attention to the confusion of terms now in existence.

Vogt classes as complicated cataracts all cataracts which appear in connection with diseases of the retina, choriod, ciliary body and iris. The clinical and anatomic differentiation of complicated cataract from senile and presenile cataract is still unsatisfactory as a review of the literature on this subject shows.

The examination with the slit lamp yields symptoms which are characteristic only for complicated cataract and which make it possible to separate it from other forms of cataract.

The complicated cataract begins with iridescence and finest opacities in the posterior polar area. Later vacuoles are formed which give the opacity a porous appearance. The process

is diffuse and there is no sharp line of separation between the affected and normal parts of the lens. The mode of extension of the complicated cataract is also characteristic. It begins in the posterior pole, subcapsular and in the posterior superficial cortex. Extension takes place in two directions; axially or sagittally, and in the direction of the posterior lens sutures. To whatever direction it extends, it infiltrates diffusely the substance of the lens like a malignant neoplasm.

Senile cataract differs from complicated cataract in the following points: 1. In posterior senile cataract other senile lens opacities in the equatorial cortical area are present. 2. The changes in senile cataract occur more frequently in the peripheral, than in the equatorial zone. 3. There is no axial or sagittal extension. Then senile cataract is concentric without increased thickness or density in sagittal direction. 4. The senile cataract is sharply defined against the neighbouring cortical substance. A combination of complicated cataract and senile cataract is comparatively frequent. Three cases are reported in which these two different types were observed simultaneously.

Traumatic posterior cortical cataract presents itself under the corneal microscope and slit lamp as a perfectly even, flat subcapsular opacity which follows the fibers of the lens, showing in its feathered and fringed appearance the smallest details of these structures. It is clearly defined from the normal parts of the lens. A report of a case is added in which a spontaneous resorption of a traumatic posterior cataract had taken place.

The genesis of complicated cataract is still obscure. The thinness of the posterior capsule is probably a factor. But also the cement substance of the sutures may have something to do with it, as experimental and clinical observations indicate that it has a special affinity for certain toxic substances.

Treatment of Incipient Cataract: —**Franklin** and **Cordes** after reviewing the work done by other observers describe their apparatus which filters out practically all rays except the gamma and report the results of thirty-one cases in the form of a table. They conclude as follows:

1. The application of radium does no injury to the normal structures of the eye.

2. It apparently has a selective action upon the lens.

3. Radium improved the vision in 84.3% of the cases.

4. A consistent technic and known dosage seems advisable.

5. Frequent treatments are necessary in the beginning.

Roorda Smit, recalling that potassium iodid has been given empirically in the treatment of cataract, reports that he gave six patients this drug. Marked improvement was noted in two out of six cases. He also noted improvement in eleven other patients treated with mercury. Mercury was given intramuscularly in the form of peptonat along with sodium cacodylat.

Scalinci after noting that iodin solution passes into the interior of the eye and may restore normal metabolism, arresting tendency to opacity, believes that local iodin treatment is worth the trial. The author believes benefits are to be expected only with cases of beginning opacities, particularly in incipient diabetes. He advocates the use of a solution not stronger than 0.25 or 0.5 per cent. He prefers a sodium iodid or rubidium iodid with a trace of calcium phosphat in the form of an eye bath.

McBean believes that the only rational use of cineraria in the treatment of cataract is that of the placebo for patients who for one reason or another are not operable.

Discission of the Lens.—**Dewey** reports discission in myopia of 20 diopters with the corrected vision on the right side improved from 5/20 to 5/9 and on the left side from 5/20 to 5/5. The operation had no influence on the progress of the myopia, which increased one diopter on the left side in a little over a year. The author believes that the operation might have its most legitimate field in a class of cases

in which the myopia runs from 7 D, to 15 D and the vision with correction is between 5/20 and 5/50.

EXTRACTION.—**Whitmore** advises the injection of 5 mm. of sterile water under the conjunctiva at the upper limbus as an aid in making the conjunctival flap.

Sternberg suggests that cocain be used instead of water to create the bleb to assist in forming the conjunctival flap.

Perlmann describes a special double forked forceps by which one is able to fixate absolutely the globe vertically to the line of incision. This is of great help and simplifies the procedure. The instrument is similar to that ascribed to Monnoyer.

Coppez makes a double fixation of the globe in operating for cataract. The rectus superior muscle is grasped with a spring forceps 5 to 6 mm. above the limbus; with another forceps, an assistant then grasps the insertion of the internal rectus muscle. After the incision is made, this second forceps is removed, while the forceps on the superior rectus muscle remains in place. It is removed only after the operation is finished. Care must be taken, that, when removing it, no pressure is exerted on the globe lest pressure produce prolapse of vitreous.

Fernandez advocates immediate capsulotomy according to the method of Trousseau.

Ewing has designed a capsulotomy forceps with sinuous cutting edges, as in the ordinary bread knife, and believes that with this type of instrument, there is less drag on the capsule, which is cut freely from within the entire grasp. This offers protection against the loss of vitreous. The drawing of the instrument is presented along with diagrams showing results.

Killen for fourteen years as an assistant to the late Dr. McKeown saw him operate 500 cases of cataract, and witnessed most of his consecutive series of 154 operations for incomplete varieties in which series there were only four total failures. The author advocates irrigation for the removal of cortex and believes it should be practiced thoroly until any blood as well as the debris has been flushed out. In older children with zonular cataract, thru a keratome incision, he sometimes washes out the swollen lens ten days after the needling. He notes that irrigation sometimes entails increased risk of escape of vitreous. He believes that nuclear cataract with a deep anterior chamber points to a hard lens with a thickened capsule and such lenses furnish contraindication for irrigation.

Bonnefon has devised a dressing for cataract and other operations which does not press on the globe, nor retain secretion, yet protects the eye. It is built up of several layers of gauze between which is sufficient cotton to form a dressing. It is circular in form, ten centimeters in diameter. An oval aperture about five centimeters across is cut out of the center. This dressing is applied to the eye and is then covered by a concave cardboard patch on the inner surface of which is a cotton plug which hermetically seals the oval opening in the pad next to the eye. This patch is retained by an elastic band about the head.

Barraquer has published an account of the first 1,000 cases of senile cataract which he has dealt with by his method. Altho convinced that extraction of cataract in the capsule was the method of election, he found the Smith Indian operation unsatisfactory owing to the force necessary to express the lens. He has devised an instrument which will adhere to the anterior surface of the lens with sufficient force to break the attachment of the capsule to the suspensory ligament and deliver the lens in its grip. This instrument he calls an erisophake. It is shaped like a small spoon with blunt edges, on a hollow handle, which is connected with an air vacuum tank. After a rather large corneal incision, usually with a conjunctival flap, the erisophake is introduced into the wound, passing thru the pupil, which is slightly dilated with a mydriatic, and brought in contact with lower half of the lens. The vacuum is turned on, which causes the spoon to adhere

firmly to the lens. By a movement of the handle, he rotates the lens around the horizontal axis, so that the upper edge passes thru the pupil. This movement ruptures the fibers of the zonula and the lens can then be withdrawn, held on the erisophake. The author says that the negative pressure of the vacuum should vary directly with the hardness of the lens and the area of the opening of the spoon with the softness. His pump produces a constant vacuum, which can be regulated. He prefers to operate without iridectomy. However, less than 1/3 of his 1,000 operations were simple.

In the thousand cases operated by his method, Barraquer obtained the following results: 7 cases of vitreous prolapse; 2 of inversion of the flap; 4 of rupture of the capsule; 3 of luxation of the lens; 2 of infection; 7 iris prolapse; 5 hemorrhages in the anterior chamber; 1 of expulsive hemorrhage.

The visual results were as follows: Vision between 7/10 and 10/10, 69.4% (694 cases); Vision between 3/10 and 7/10, 24% (240 cases); Vision between 0 and 3/10, 6.3% (63 cases); Vision 0 0.3% (3 cases). The operation was done with conjunctival flap 685 times; With previous suture of the cornea in 315 cases; by the simple extraction method, in 219 cases; by iridectomy in 251 cases.

In the American Journal of Ophthalmology: Vol. 3, No. 10, pg. 721, photographs of this method appear. A similar procedure was advocated by Hulen in 1911 in the Journal of the American Medical Association.

Wieden in discussion warmly recommends Barraquer's method, claiming as advantages the extraction of the capsule, and the absence of pressure against the eye, thereby avoiding vitreous prolapse; and **Ruiz** considers that the systematic employment of the corneal sutures has many advantages, among them being the avoidance of iris and vitreous prolapse. The suture allows a perfect coadaptation of the borders of the wound, thereby avoiding the danger of infection and facilitating more perfect cleaning of the anterior chamber from any cortical remains. The time of recovery is shortened, especially the time when the patient has to be in bed.

Velez has used Barraquer's method in the extraction of cataract in its capsule, but prefers the name "facoabulsor" for the instrument used instead of "erisifaco" used by Barraquer. Velez prefers the method of Barraquer as easier and less dangerous than that of Colonel Smith, of India. **Coppez** depicted phakoerisis by motion pictures.

Piccaluga proposes modification of the corneal suture in cataract extraction wherein a suture is anchored in the corneal tissue parallel to the limbus and tied, leaving one end free. The second suture is placed in the scleral tissue parallel to the limbus and tied, one end being left free. The wound is closed by tying these together.

Oliveres is an enthusiastic exponent for suturing the cornea in cataract extractions. It is his opinion that the danger of prolapse of the iris and hernia of the vitreous is minimized when the suture is used, and that the wound heals more smoothly and the danger of postoperative infection is lessened. **Dujardin** sutures the cornea after the method of Lapersonne in his cases of cataract extraction.

Dowling describes the following procedure for the removal of soft cataracts. The pupil having been previously dilated with homatropin, an incision is made with a thin Graefe knife entering at a point one or two millimeters below the meridian of the eyeball. The blade is carried across the anterior chamber making the exit at a point 1 or 2 millimeters above the meridian of the eyeball. The incision is extended by backward and forward motion of the knife blade until a broad incision is made at the temporal side and an incision about 2/3 its length at the nasal side, leaving a broad corneal bridge between the two. Capsulotomy is performed with either a capsulotome or a Knapp's knife needle. A grooved spatula is introduced thru the small incision which separates the lips of the wound. Thru the temporal incision, the straight tip of a small barrel syringe is introduced. The tip

is carried thru the opening of the lens capsule passing beneath the iris. Lens material is irrigated out by means of gentle syringing, the tip of the syringe being moved in various directions until the pupil is black. The iris is replaced and the corneal circumference is gently stroked until the pupil is round. Eserin is instilled and the eye bandaged.

Hallett reports three cases operated according to the method advocated by Dowling with satisfactory results. In the fourth case there was a rupture of the posterior capsule with loss of vitreous. A stormy iritis developed and prolapse of the iris.

Ascher reports his experience in 129 expressions in which a slight modification of the original procedure of Smith was carried out. Of these 97 were made in noncomplicated, and 32 in complicated cases. Sixty patients had on one eye expression and on the other extraction done. The result as to vision was the same in both methods.

In 35 noncomplicated, and in 5 complicated cataracts the expression had to be abandoned. The influence of age is seen in the fact that expression in patients of the 7th and 8th decade were easier than in younger patients. The immature cataract showed the higher percentage of abandoned attempts at expression. There seems to be also a racial difference. The failure to express the lens was less numerous in Jews than in Non-Jews, while 0 per cent of the Jews and 16.4 per cent of Non-Jews showed prolapse of vitreous humor.

14.4 per cent of expressions in noncomplicated cataract were complicated by prolapse of vitreous humor. This occurred only in patients of the 7th and 8th decade, and the immature forms showed it more frequently than the others.

A comparison between the simple expression without iridectomy and extraction favors decidedly the latter method; prolapse of vitreous humor 30% and 3.1%; prolapse of iris 10% and 2.2%. The best results with simple expressions were obtained in Morgagnian cataracts, while in nuclear cataracts the results were not satisfactory.

Indication for expression combined with iridectomy was rigidity of the sphincter, degeneration of iris, high age. Prolapse of vitreous humor was observed in 10.3 per cent of these cases. A vision of 0.2 was the result in 62.2 per cent. In 32 combined expressions for complicated cataract, prolapse of vitreous humor was seen 10 times. In 5 cases the attempt had to be abandoned.

The author reaches the following conclusions: Simple expression is not to be recommended except for Morgagnian cataract. An attempt of combined expression is permissible in all cases where any procedure combined with iridectomy is indicated: in patients above 60, with mature, overmature, nuclear and Morgagnian cataracts (but not with cortical and immature cataracts). Simultaneous extraction on the other eye is no contraindication. Simultaneous expression on both eyes is well borne. Smith's method does not shorten the time necessary for healing, nor does it guarantee a better vision.

Sternberg quotes his experience with 23 cases of intracapsular extraction. He advises the use of a small conjunctival flap. He emphasizes the necessity of a large incision and the importance of an assistant trained in the holding a Fisher hook. The author does not believe in flushing the eye after the extraction. If all has gone well, the eye is not inspected for a week. Preliminary iridectomy is not thought necessary.

Delayed Healing.—**Parsons** reports a case in which he had done iridotomy. Extraction was done with a peripheral button hole, a tiny hole, just in the periphery of the iris. After the patient was discharged from the hospital, she returned with a hypopyon and flaring iritis, which the author regarded as due to endogenous infection. Despite treatment, the pupil became blocked. He performed an iridotomy, puncturing the iris and passing a Tyrrell's hook in behind the iris with the idea of coming out of the tiny col-

oboma at the top. There was a small breach in the iris and the patient was left with a small artificial pupil below. Corrected vision was 6/18.

Colin temporarily paralyzed the lids after the method of Villard and did an uneventful extraction with a flap. The next day, however, he found the flap, was reflected and a compressive bandage was applied. The subsequent course was uneventful, but vision was only 1/20, from opacity of the cornea and irregular astigmatism. Since then he has avoided this accident by holding the lids together by a piece of English taffeta 1 x 7 cm. applied perpendicularly to the lids.

Zotzdziowski saw a case with small detachment of the ciliary body following extraction of a traumatic cataract. The detached area corresponded to the coloboma of the iris and protruded into the anterior chamber. Zonular fibres could be seen extending from the ciliary processes of the detached portion to the remains of the lens capsule. The intraocular tension was diminished.

Santos Fernandez reports a patient with a purulent dacryocystitis who was blind from a cataract. Treatment for the dacryocystitis was refused. Extraction of the cataract and after-treatment was done under irrigation with ice cooled water and compression of the lacrimal sac. Primary healing without complication. The author reports this as an exceptional case.

Monbrun observed that in four cases operated upon for cataract in which there was delayed healing or infection, there was anesthesia of the cornea. He believes that by testing the sensibility of the cornea valuable prognosis as to the result of operation, may be gained. **Shields** showed a case of old posterior synechia and lens opacity.

AFTER CATARACT.— According to **Kuhnt,** there are no measures, with the exception of extraction of lens within its capsule, which absolutely prevent the development of secondary cataract. It is desirable to remove as much of the anterior capsule as is possible. The cortical debris should be carefully removed. Tho this will not prevent secondary cataract, it will retard it temporarily. There is no method of operation for secondary, which is suitable for all cases. Operative procedures must vary according to the duration, firmness and thickness of the membrane. The safest and most successful treatment is early discission done from 16 days to four months after the extraction. This is best performed under artificial light with a subconjunctival puncture. By this method, there is a minimum of injury done to the vitreous. The incision should be between 7 and 8 millimeters long and three millimeters wide. The fibers should be cut vertically to the longitudinal axis. Early subconjunctival discission is indicated because of its safety and as a prophylactic operation, in all cases where clinical experience leads one to expect development of the secondary membrane. The spongy form or secondary cataract is usually caused by the slight chronic senile cyclitis. In these cases it is necessary to operate with two needles at the same time to avoid undue traction on the ciliary body. Later on, it may be necessary to make an additional incision upward and downward from the first incision in the form of an inverted "T." This procedure is also indicated in older membranes which are rather thickened or in secondary cataracts where the remnants of the capsule adhere to the incision causing permanent irritation and particularly in cases where loss of vitreous has taken place at extraction. Serious cyclitic irritation or increased intraocular tension have never been noted since subconjunctival methods have been used.

In older, more firm and rigid forms of secondary cataract in which a sufficiently large opening cannot be obtained by discission alone, partial or total extraction of the capsule is indicated. The safest method of extraction which produces the minimum traction on the ciliary body is to incise the capsule with a lancet shaped needle, care being taken to avoid escape of the vitreous. The capsular opening is made by means of a small iris hook. It is wise to leave the cap-

sule segment nearest to the scleral incision, in the eye. Prolapse of the vitreous and disfiguration of the pupillary space can thus be avoided. In cases where isolated firm bands occlude the pupillary space and where the state of the vitreous is known, the best method is to cut out a sufficiently broad strip of the secondary membrane.

Ziegler calls attention to an almost invisible filmlike membrane that may form over the vitreous surface after operations for secondary cataract. Ziegler believes that the mildly corrosive action of a chemically perverted aqueous secretion is responsible for the formation of this filmy opalescent membrane. He advises V shaped capsulotomy. He concludes that "adventitious hyaloid membrane," altho of rare occurrence is a distinct pathologic entity. The cardinal symptoms are:

1. Lowered vision for near when the distance vision is good.

2. The presence of an iridescent vitreous reflex as revealed by oblique illumination.

A case is reported.

Levinsohn describes a special sickle shaped knife with a semicircular curvature which was constructed by him for the discission of secondary cataract. It has successfully been used by different operators in 131 operations. It can be introduced thru the cornea as well as thru the sclera.

Kuhnt criticises Levinsohn's sickle shaped discission knife. He thinks that the semicircular curvature especially requires rather complicated movements of the hand when introducing and withdrawing it. There is then always a danger of involuntarily making the scleral and corneal incision too large with all its consequences: Emptying of the anterior chamber, prolapse of vitreous humor.

The difficulties which are experienced in the discission of the different forms of secondary cataract, cannot be solved by the construction of one special instrument, but by using different operative procedures adapted to the individual case.

Fox, from his experience, believes that in thoroly mature cataracts secondary membranes follow in only about 25% of cases. In the immature cataracts, the percentage is reversed. The author advocates the method of dividing the membrane as described by de Wecker, that is making a vertical incision thru the cornea and capsule with an English broad needle, then snipping the capsule with a small de Wecker scissors. He selects this method because of the freedom from using force in lacerating the capsule with no pull on the ciliary body. He believes that the secondary operation should be done in about 6 to 8 weeks.

Jackson pointed out that the capsule of the crystalline lens varied in thickness at different distances from the center of the pupil. The capsule itself is passive; whatever changes occur in it must be due to the epithelium adherent to it, and to other tissues that become associated with it. The density of such membranes after cataract extraction is connected with the severity and persistence of postoperative inflammation. Such inflammation is largely due to lens substance, remaining in contact with the iris. It is generally absent after intracapsular extraction, after thoro irrigation of the anterior chamber following extraction: and also after the operation with peripheral capsulotomy, when all cortex left within the eye is left in the capsule and not in contact with the iris.

Postoperative Infection.—**Butler** in discussing postoperative infection says there are two types of inflammation having a different etiology: First the acute wound infection, the septic hyalitis, panophthalmitis, most probably due to infection from without, mostly by the pneumococcus often driven from a diseased sac or an ethmoiditis. In the second group the cause was mostly an endogenous infection, or due to general toxemia. He regards diabetes as a fruitful cause of failure. **Marquez** writes on postoperative infection after cataract extraction.

Duhamel advises investigating the condition of the lacrimal sac in all

cases where a cataract extraction is contemplated.

Stargardt divides postoperative suppuration into 3 groups: Infection of the wound and cornea. Infection of the sac of the capsule and infection of the vitreous. When the cornea is infected Kuhnt's method must be adopted. A double pedicled conjunctival flap is cut and the wound is examined to see whether the anterior edge alone or the deeper layers of the cornea are affected. If the former, the edge is freely cut away with the scissors. If the deeper, the cornea is split and the soft tissue scraped out with a small scoop. The anterior chamber is washed out with normal saline or with oxycyanid of mercury and the wound covered with a conjunctival flap. This procedure is better than cauterization. Optochin and vouzin are useful in these cases, more especially when the cornea alone is infected. Isolated infection of the chamber is seen clinically under the picture of an iridocyclitis with or without hypopyon. The chamber is washed out with normal saline or with a 1/5000 solution of oxycyanid of mercury. Kuhnt recommends that the chamber be drained once a day till the iris regains its correct color. When the capsule sac is infected it must be removed with forceps, one blade behind and one in front. A case is cited in which this treatment was successful. The author recounts several cases in which drastic treatment has saved the eye.

Delirium.—**Fisher** after quoting the literature on the subject of delirium finds that the causes given are: bandage, loneliness, stomach trouble, run down condition and nervousness, circulation disturbances, preoccupation before operation, regimen to which the patient is submitted, fear of losing sight, alcohol and being deprived of it, atropin, senility, psychic, autointoxication, homesickness, mental shock and fright. Treatment recommended: removal of bandage from the unoperated eye, chloral and bromides, alcohol to alcoholics, attention to bladder, pelvis, urine and blood: mixture of nux vomica, cinchona and gentian after operation and ambulatory treatment. The author reports four cases. He emphasizes the necessity of care in getting history of patients before the operation. He believes in all cases, when possible, one of their friends should remain with them during the entire stay in the hospital and upon the slightest tendency to delirium have their friends, who are their attendants, attempt to wake them up and persist in the attempt.

Jackson speaking of the danger of delirium or more permanent insanity arising to complicate the after treatment of cataract extraction believes that the subject is of sufficient moment to warrant the careful attention of every ophthalmic surgeon. He calls attention to the fact that the exciting causes are present and occupying a large part of the subjective life of the patient. He believes it the duty of every one who operates to guard against the danger of delirium in every possible way. Patient's surroundings should be studied with reference to mental condition and environment. The surgeon should plan to guard the patient against danger of diminished elimination, unnecessary shock, avoidable change of environment, excessive excitement, or anxiety about the result.

Extraction of Cataract.—**Vail** advocates intracapsular extraction according to the method of Smith. When it is discovered that pressure on the eyeball with Smith's lens-hook, fails to detach the lens and start it on its outward course, he makes no further effort to deliver the cataract in its capsule, by means of the lens-hook. He then directs the patient to look down, passes the end of an interior capsule forceps, of his own design, behind the iris between it and the lens before opening the blade. Only after passing behind the iris are the closed blades spread and the anterior capsule is seized near the lateral extremities. By gentle manipulation, the zonule is ruptured. The forceps is gently withdrawn bringing with it a large bite of the anterior capsule. The nucleus and cortex is removed by means of the

lens-hook. No attempt is made to rid the eye of the remaining cortex. The author advocates Smith's procedure when the lens shows a disposition to be delivered without strain. He believes in operating when the patient can no longer read newspaper print with the best glasses in ordinary light.

O'Connor's paper is an adverse criticism of the Smith method. It contests the claim that the method is the safest and best for general adoption without denying that it may have a place in practice of certain operators adverse to other methods of operating. The author prefers a large corneal incision with a conjunctival flap, removal of a large bite from the anterior capsule using the Kalt forceps. Expression of the lens with a flexible tortoise shell spatula and Fisher needle. The author compares his results with those of operators employing the intracapsular method.

Parker believes that the Smith-Indian operation can be successfully performed in certain cases but when complications arise, they are often so serious as to force one to the conclusion that the combined extraction is the safer procedure, at least in this country. The removal of the lens and capsule by the method of Torok and Knapp and especially when performed with Verhoeff's modification of the Kalt forceps is much less hazardous than the Indian operation. A simple extraction is performed in young patients and in selected senile cases. Preliminary iridectomy was performed in cases where cataracts were developing equally in both eyes and no improvement of vision could be obtained by the use of mydriatic; also in cases known to have fluid vitreous or in which the operation on the fellow eye had been followed by serious inflammatory reaction and all cases with even suggestive symptoms of glaucoma.

Jackson believes that the intracapsular method cannot be advanced as the only method of extracting unripe cataracts. Since the introduction of the knife needle thru the vascular limbus, rather than thru the clear cornea, has been practiced the operation is practically devoid of danger from infection. He points out that in only one-half of the cases is the secondary operation necessary. Neither is the intracapsular method, the only way to avoid postoperative inflammation due to the presence of cortex in the anterior chamber. The opening of the capsule at its periphery as was done by Herman Knapp and as practiced by Jackson gives equal immunity from postoperative inflammation. He points out that the seriousness and formidable character of the cataract depend on the length of the incision required to furnish adequate outlet for the senile crystalline lens. Discission, linear extraction or the old suction operation on a soft lens are much less formidable. He predicts that the next rational change proposed for the operative treatment of cataract will be some method of cutting to pieces or crushing the firm nucleus, which would permit the removal of the lens thru a relative small opening.

Beck wrote on the advantages of the intracapsular method of extracting cataracts. The author follows the method as modified by Fisher.

Shields reported two cases of intracapsular extractions. He obtained good results in both. **Andrade** writes on the operative treatment of unripe cataract.

Walker described the clinic of Colonel Smith of India. Up to date Smith has done about 50,000 intracapsular extractions. The Colonel is also a general surgeon of ability.

Lowell submits his experience with 17 cases of cataract operated on according to the method described by Husain of India. Husain's method is as follows: a small opening is made in the conjunctiva one cm. above the sclero-corneal margin, the patient looking down. This is enlarged from each side horizontally to 1½ cm. in length keeping the line of incision equidistant from the sclerocorneal margin. Thru this opening the subconjunctival tissue is cut to the limbus. With the scissors closed and with lateral movements, pockets are made on

each side of the central subconjunctival tunnel. The lower margin of incised conjunctiva is lifted with forceps. The anterior chamber is punctured at the sclerocorneal junction with an angular keratome. Conjunctival flap is still held with forceps in left hand. Thru incision made by the keratome, one blunt blade of the scissors is passed into the anterior chamber above and along plane of the iris. The opening is enlarged first on one side and then on the other until sufficient for the delivery of the lens. Iridectomy, capsulotomy and delivery is proceeded with in the ordinary method. Any blood which collects in the anterior chamber should be removed by irrigation at once. Cortical debris is removed by irrigation. After replacing pillars of iris, the conjunctival flap is smoothed back and one stitch placed centrally, which is removed on the third or fourth day. Both eyes are bandaged for 6 or 8 hours at which time the unoperated eye is uncovered. Husain claims that chief advantage of operation is rapid healing of the conjunctival wound and claims suppurations are reduced to 0.4 per cent. This operation is based on the work of Czermak and Hari Shanker.

PREPARATION.—**Snyder** believes that the care of the cataract patient should start, if possible, several months before the operation. He lays stress upon the necessity of a careful history and thorogoing examination. He advocates the use of atropin and morphin before the operation, and prefers the afternoon to operate so as to insure the patient a good first night. He attributes great importance to a comfortable bed.

McReynolds calls attention to the necessity of careful attention to the mental as well as physical preparation of the patient.

Robertson reports a case in which following the extraction on the right eye, the left eye which was cataractous improved from 18/40 to 18/20 with a marked clearing up of the lenticular opacities. The only medication used was 32 doses of 15 grains each of sodium salicylat.

A woman, 30 years of age, with pain in the eye and loss of vision, was seen by **Dewey.** The lens was slightly opaque and became completely cataractous in four months. Later the vision began to return and when examined a year and a half later, the pupil was clear and the cataract had *absorbed spontaneously.* With correction the vision was 5/15.

Jackson believes that a simple technic is always to be preferred in operating for cataract. Next after simple technic he ranks smooth incision and then the conjunctival flap to guard against infection, and in general the smallest incision compatible with avoidance of bruising the tissues. He reiterates that certain general surgical principles should dominate all plans. They must not be lost sight of in the enthusiasm for what is supposed to be new, and is hoped to be better: and states that individual skill is more important than any special method.

Sattler writes on the choice of one stage or two stage operation for cataract.

Woodruff gives certain practical measures for avoiding dangers that beset cataract extraction. The author advocates leaving a bridge of tissue in the corneal incision until the speculum is withdrawn as a guard against loss of vitreous in cases where the zonula is known to be ruptured as in dislocated lenses, traumatic cataract. The author concludes:

1. Vitreous prolapse is less apt to occur if anesthesia is thoro. Softening of the corneal epithelium is of little consequence compared with vitreous prolapse.

2. Incision must be large enough so that moderate pressure causes the lens to present.

3. The knife must be as sharp as possible to avoid unnecessary traction on the eye.

4. After operation is completed, do not touch the eye without a word of caution to the patient and better have the speculum removed.

5. Do not allow the cilia to be removed.

6. In cases where vitreous prolapse is a probability either from lack of self control on the part of the patient or from

diseased conditions in the eye itself, do not immediately complete the corneal section with the knife: but remove the speculum and complete the incision with the scissors.

From a study of 1,058 cataract extractions done by Koster at the Leyden Clinic between 1895 and 1918, **Meyling** concludes that: 1. The combined method of extraction is the better operation for senile cataracts. 2. Total maturity is not necessary before operating. 3. Syringing of the anterior chamber is not good practice. 4. The second week after extraction is the best time for discission of a secondary cataract.

Canelli analyzes what has been published on progressive lenticular degeneration since 1912.

Laas gives the following advice to those who are doing their first operations for cataract:

1. Operation with the best artificial light and binocular loupe.

2. Subconjunctival injection of novocain-suprarenin solution instead of the usual cocain drop method of anesthesia and instillation of 1 per cent solution of pilocarpin to prevent dilatation of the pupil.

3. Formation of a conjunctival flap with two peduncles from the conjunctiva along the upper cornea. The sutures are put in, ready to be tied in case of emergency (prolaps of vitreous humor) and their ends are spread over a sterile towel.

4. Incision with the keratome and not with the knife. The incision may be enlarged, if necessary, by one of the cutting edges of the keratome when drawing back the instrument. Should the incision not then be large enough it may be widened with scissors. The keratome should be a broad one.

5. Opening of the anterior capsule of the lens with the point of the keratome.

Castresana removed a cataract from a patient, aged 16, who immediately following the operation was dumbfounded, dazed and apparently indifferent. Answers to questions were obtained with difficulty. A match box was the only object named correctly, altho she claimed to see everything perfectly. But if she could touch any object, she named it correctly. She said the sky was black, until told that it was the sky, when she said it was blue, because she had previously heard that the sky was blue. Dazzling colors she could name, because she had seen them before her operation.

Hirschberg writes on the nomenclature of the crystalline lens.

The Vitreous Humor

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This review covers the literature from April, 1920, to April, 1921. For previous literature see Ophthalmic Literature, v. 16, June, 1920, p. 151.

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DIGEST OF THE LITERATURE.

EMBRYOLOGY.—Thru the histologic examination of an anomalous eye, **Howard** was able to study the origin of the vitreous. In his specimens, protoplasmic connecting fibrillae were found, extending from the innermost layer of the embryonic retina, from the pars ciliaris retinæ, and from the fibro, vascular sheath of the lens. The author's case supports the theory of the mixed origin of the vitreous; i. e., from ectoderm and mesoderm.

Based upon the findings of his case and the histology of the normal embryo, the author suggests the following chronologic and genetic classification of the vitreous of the human eye:

1. A transitory ectodermal vitreous, originating from the innermost cells of the primitive retina, and from the basal cones of the primordial lens.

2. A transitory mesodermal vitreous originating from the connective tissue cells that enter with, or proliferate from the hyaloid vascular system.

3. A definitive or permanent ectodermal vitreous, originating from the cells of the pars ciliaris retinae.

Nordenson writes on the transparency of the anterior layer of the human vitreous at different ages.

PROLAPSE.—The more intense illumination afforded by the slit lamp has revealed conditions in the anterior segment of the eye which have hitherto been unobserved. With the Nernst slit lamp, **Hesse** was able to study prolapse of the vitreous into the anterior

chamber in 9 cases. With the exception of one case, a patient with a high degree of axial myopia, the prolapse followed an injury to the eye. In one case the wound perforated the eye ball, the others were contusions. One or several beads of vitreous were observed as sac like protrusions into the pupillary area. The edges of the sac were pigmented in several instances, and some contained a small quantity of blood. In one case, the vitreous retracted in 2 months, and in another, the prolapse was still present 6 months after the injury.

In most cases, the lens was subluxated, and the iris pushed forward by the tongue of vitreous, which had pushed between the anterior surface of the lens and the iris.

Floating Bodies:—**Frogé** saw peculiar translucent floating bodies in the vitreous in a patient, who had retinitis proliferans. **Myashita** writes on vitreous opacities.

Gibson saw a boy, 11 years of age, who had received a blow on the right eye. At the age of 4 years the same eye had been injured by a piece of wood which penetrated the globe, and an iridectomy for prolapse of the iris had been done. The second injury produced a rupture of the iris at its base inferiorly, and thru the opening a jelly like hernia of the vitreous protruded into the anterior chamber. The boy had been under observation for two years. In this time the hernia had increased slightly in size, but the eye has not troubled the patient. **Rönne** reports hernia of the vitreous following injury, and **Weill** hernia of vitreous body in glaucoma.

Hyaloid Remains:—A woman, 29 years of age, with hyaloid remains in the vitreous of the right eye, was presented by **Crisp.** A wavy black strand, which was fairly motile, extended from the disc to the posterior pole of the lens. With a correcting lens, the vision was 5/10 plus.

In **Suker's** case, the remains of the hyaloid artery had three branches, which were free and motile. The main trunk was about 5 mm. in length and was not motile. The branches varied from 3 to 5 mm. in length. The superior temporal artery showed a fusiform dilatation of almost 5 mm. in length. Vision was normal.

Perry saw a thread like hyaloid remain, which was attached to the posterior capsule of the lens. It tapered off and ended in the vitreous. The vision was normal. **Vogt** writes on physiologic remains of the hyaloid artery.

Hemorrhages:—A simple sclerotomy, done by **Bettremieux** and **Gandt,** gave relief from pain, in a case of traumatic hemorrhage into the vitreous.

Davis reports a case of recurrent retinal hemorrhage of adolescence in a male 19 years of age, and contrasts it with a similar case which he reported in 1912 (Y. B. 1912, p. 237). Both were males, young and in perfect health until date of eye trouble. History of tuberculosis in family of each. Both reacted strongly to the tuberculin tests, general, local and focal. Each had recurrent retinal hemorrhages into the vitreous, retinitis proliferans and finally detachment of the retinas and loss of sight.

Points of Variance —Case 1. (1) Had a pronounced perivasculitis from the start, the retinal vessels being affected from the disc to the extreme periphery of the fundus; (2) The optic nerve was little involved and secondarily; Case 2. (1) Had no perivasculitis noted at any time; (2) The optic nerve was markedly involved in the left eye (swollen 3D.); and moderately so in the right with pronounced edema at the macula; (3) pronounced choroidal changes especially in the left eye.

The author concludes that his cases show two types as described by Siegrist; viz., in one, the veins, especially at the periphery were involved; while the optic nerve and the veins in and near the optic nerve were not involved. In the other, the central veins and optic nerve were involved.

Gonzalez practiced autohemotherapy for the treatment of spontaneous hemorrhages into the vitreous in a young man. The patient was neither

syphilitic nor tubercular. The hemorrhages into the vitreous began after the cessation of frequent attacks of epistaxis, which had occurred since childhood. The patient's blood coagulated slowly. After subcutaneous injection of 5 cc. of the patient's own blood, the coagulation time increased.

Friedenwald presented a case of retinitis proliferans of the left eye in a young man. A hemorrhage had occurred into the vitreous a few weeks before. A retinal vein extended into the vitreous, and entered the connective tissue, simulating a localized detachment of the retina.

Aubineau believes that the recurrent hemorrhages into the retina and vitreous during adolescence, is due to hemophilia.

Suganuma was able to demonstrate periphlebitis and tubercles in sections of eyes taken from a patient who had had recurrent hemorrhages into the vitreous. The paient died following a pulmonary hemorrhage. The author remarks that this was the second time that these changes had been noted in sections; Fleischer having found similar conditions in his sections.

Zentmayer discusses the symptom complex of recurrent retinal hemorrhages, reports four cases which came under his observation; and elucidates the various views held with regard to the etiology, pathology, diagnosis, and treatment.

The writer believes that the picture of tuberculosis of the retina is not constantly found in these cases, and that some other factor is frequently responsible. Disturbance of the endocrine organs, especially the adrenals, whether acting independently or in conjunction with tuberculosis, is suggested as a possible etiologic basis for this condition.

During his course of lectures in Madrid, **Fuchs** takes up the different affections of the vitreous.

Valentine writes on fat substance found in the vitreous of the horse.

The Retina

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This section of the Digest carries the literature from April, 1920, to May, 1921. For previous references see O. L. v. 16, p. 153.

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DIGEST OF THE LITERATURE

ANATOMY.—The terms "fovea" and "macula" have led to confusion, **Vogt** declares. Examination with red free light has demonstrated that only about the central third of the depression enclosed by the foveal edge has a yellow color; only this smaller central part containing the foveolar reflex should be called macula or macula lutea, while the whole depression which is about disc size should be called the fovea. The foveolar reflex lies in front of the retina and is produced by the concave mirror of the central pit; it moves in a direction opposite to the light and to the movements of the observer, while the circumfoveal reflex moves in the same direction. The comet or fan reflex of Marcus Gunn can be made longer or shorter by movements of the mirror. In pathologic cases Vogt found a foveolar reflex which moved with the light; it was found in both eyes of a boy with bilateral transitory exopthalmus of unknown origin, and since it was yellow it must have originated in the deeper layers; this kind of reflex is found at times together with the ordinary foveolar reflex, as in a case of bilateral chronic iridocyclitis. In cystoid degeneration of the macula was seen a third form of reflex, as a white reflex moving with the light, which must have been caused by a bulging of the limitans interna.

Ora serrata for the serrated border of the retina is wrong according to **Alexander,** being wrongly in the plural; limbus serratus would be better. The border of the retina is serrated because the retina, before it ends, in passing for a short distance over the last extremities of the orbiculus ciliaris is being raised upward by the subsidiary processes and thrown into a series of elevations and depressions, thus acquiring the serrated appearance.

The position of the single and double foveae of the birds and their functional relation is discussed by **Rochon-Duvigneaud.** In the birds with single fovea whose eyes are placed purely lateral the two eyes are independent of one another as proven by the monocular pupillary contraction to light and the fovea lies near the optical axis. In the diurnal birds of prey who have one central and one lateral fovea the two foveas of the one eye are independent of those of the other eye; the double fovea is an admirable apparatus for estimating distances. In the nocturnal birds of prey the single but lateral fovea of the one eye is again independent of that of the other eye, in spite of the optical axis of the two eyes forming an even smaller angle than in the cat, and the decussation of the optic nerves is therefore with them also complete. Viewed from the stand-

point of human and mammalian physiology, these things are difficult to understand and it will be necessary to study the visual lines in the birds and the central connection of their retinae. **Delage** explains double fovea in predatory day birds.

EMBRYOLOGY.—To study the development of the retinal pigment, **Smith** examined the retina of the chick embryo in culture and film preparations. Various stains were used, principally neutral red and janus green. The most important conclusions are: The pigment granules were not observed to be extruded from the nucleus; there was no evidence that the mitochondria changed into pigment. So far as could be determined the granules arise and develop in the cytoplasm of the cell.

In specimens of the chicken embryo from the second to the tenth day treated by the silver impregnation method of Ramon y Cajal, **Munoz Urra** found that the embryonal neuroblasts in the retina frequently developed in a wrong direction. These faulty structures soon disappear and only the normal ones remain. The embryonic neuroblasts show various aberrations from the normal. They will at times grow in a direction opposite to the one they should take; several will unite by their projections and continue united to the nerve fiber layer; some very fine axis cylinders turn backward into the outer layers; some show hypertrophy and of these some are attracted toward one another and arriving at the nerve fiber layer turn backward to the outer layers; others show bifurcated projections. The neuroblast is an isolated free unit; it grows, develops and lives alone, obeying only certain attracting substances without any path being carved out for it. These supposed attracting substances, Munoz Urra believes, are given off by the surrounding elements.

In its development the optic nerve shows a remarkable independence of the surrounding tissues, according to **Munoz Urra.**

CONGENITAL ANOMALIES. *Persistent Hyaloid Artery* and *Fusiform Aneurism.* Aside from persistent hyaloid artery the eye of **Suker's** patient also showed a fusiform dilatation of the superior temporal artery about 5 mm. in length.

Optico-Ciliary Veins.—In each eye of a four year old boy with tower skull and optic atrophy, **Kraemer** discovered an optico-ciliary vein. The vessels were symmetric, on the temporal side of the discs; they had all characteristics of a retinal vein including the central reflex while on the disc and the adjoining conus, but lost these peculiarities and assumed characteristics of choroidal vessels as to size and color and lost the central reflex in the further course in the choroid.

PECULIAR FUNDUS ANOMALY.—In a highly hyperopic amblyopic strabismic eye **Kraupa** observed a peculiar white formation extending from the disc into the retina.

PHYSIOLOGY.—Experiments on the eyes of curarized animals of different vertebrate species, undertaken by **Kohlrausch** to find the relation of retinal currents to the different colored lights and to state of adaptation, gave results which can be harmonized with Piper's hypothesis and the duplicity theory. But the relation of the retinal currents to the functions of the retina which underly the visual sensations and the process of adaptation is still to be determined.

In utilizing our knowledge of the physiology of the organ of sight to help solve the problem of night blindness, we must understand what night and twilight mean and how strong the illumination and the contrasts are under these conditions. **Roelofs** and **Zeeman** declare light sensibility and visual acuity in reduced illumination as well as power of adaptation, refraction, size of pupil, condition of media, etc., will have to be considered. The illumination during a clear March or April night amounts to about 0.0003 meter candles. It now must be investigated what the light sense and the visual acuity are under these conditions of feeble light. Measured with their special light sense measure, an object seen after light adaptation would not be seen under this feeble illumination but would become visible after dark adap-

tation and is even above threshold after long adaptation. The visual acuity under feeble illumination must be investigated, the size of the perception circle as well as the sense of direction. Under different illumination of the glass plate of their apparatus the distance was determined at which various objects were recognized after dark adaptation of twenty minutes. Increase of light was found to increase the visual acuity. This increased acuity shows itself in the size of the perception circle and perception width as in the perception direction differences. With an illumination corresponding to 0.0003 meter candles the values found for the two observers correspond to 1/40 to 1/50 of the visual acuity of the clinical methods. But these results were obtained with great contrasts in illumination; under natural conditions the contrasts are much less and the visual acuity will be correspondingly smaller. Under feeble illumination and with minimal contrasts not only the visual acuity is to be considered but also the rapidity with which objects are recognized. From all data obtained it appears that visual acuity depends upon the illumination but great variations in the illumination produce only small variations in the visual acuity; only a small visual acuity suffices to allow free mobility in semidark surroundings. Small variations in the light sensitiveness are not likely to give rise to hemeralopic complaints.

These experiments made on normal emmetropic individuals were repeated in order to study the influence of refraction anomalies and abnormal pupil. For this purpose glasses of different strength and stenopaic holes were employed. Roelofs and Zeeman found that artificial refraction anomalies do not alter the light sensitivity, but the necessary light quantities were greater than for the naked eye and that even the strongest illumination could not increase the visual acuity beyond a certain maximum existing for that refraction anomaly. Weak myopic glasses seemed to give better vision, contrary to the general rule; no explanation is offered for this exception. The emmetrope will therefore still be able to move about in feeble illumination when the ametrope is already helpless. Stenopaic openings produce a higher threshold value, but a small pupil favorably influences the sharpness of the image in strong illumination even with refraction anomalies. One observer needed more light for large objects and less light for smaller ones than the other observer; this also is explained as due to the different pupillary opening. Uncorrected hyperopia will, when coupled with weak accommodation lead to difficult orientation in the dark. The greater or less clearness of the media will lower or diminish the threshold values. The influence of diminished transparency of the lens has been shown to give hemeralopia by Koeppe (Y. B. 15, 1918-19, p. 155). Absorption of the blue light by the yellowish lens of old age will produce hemeralopic symptoms. Psychic factors play a role in the appearance of night blindness as attention, experience, fatigue, intoxication. All these results easily explain the reason why disturbance of light sense and of adaptation has been found wanting in such a large percentage of cases of night blindness during the war.

Investigating the color sensitivity of the retina in sixteen meridians with lights of high intensity derived by means of their special spectroscopic apparatus, **Ferree** and **Rand** arrived at the following conclusions: 1. The periphery of the retina is not blind to red, blue and yellow. It is merely deficient in sensitivity and with stimuli of sufficient intensity the limits of red, blue and yellow coincide with the limits of white light vision. The peripheral blindness to green, however, was for their observers absolute. 2. The amount of change of intensity required to produce a detectable change in the apparent limits of sensitivity in the more remote parts of the retina is great and changes very irregularly from center to periphery in a given meridian and from meridian to meridian. 3. The shape of the zone of sensitivity to a given color changes

with the intensity of the stimulus employed. When stimuli of equal or of the same order of intensity are used the limits for red, yellow and blue interlace or criss-cross each other irregularly. The lack of uniformity of grading of function from point to point in the periphery is just what might be expected of those parts of a sense organ which are little used and poorly developed. 4. The responsibility of the accepted clinic rating of limits in the order from widest to narrowest of blue, red and green rests with the relative intensities of the pigment stimuli used. 5. The interlacing of limits for red and blue is a normal result for stimuli of equal energy of medium intensities. It may not, therefore, be due to pathologic disturbance in the distribution of sensitivities as has been claimed. The apparent limits are dependent both upon the actual distribution of the sensitivity and the numerous factors which affect the apparent powers of response of the peripheral retina.

From a comparative discussion of the photosensitivity of the retina and the photoelectric properties of some substances **Coblentz** believes some clue might be had as to how the eye functions when exposed to light. The eye is one of the most sensitive detectors of radiant energy, but unlike a thermopile, or a blackened thermometer (which responds equally to all frequences of equal energy value) it is selective in that it is sensitive to only a limited range of frequencies of radiant energy, called the "visible spectrum." The physiologic response is greatest in the yellow green and drops off rapidly in the red and in the blue; it differs in different persons, some being specially sensitive in the blue, green or red. Partially color blind have a distorted visibility radiation curve, which in the totally color blind is shifted to the blue. For ordinary intensities the full visual sensation is attained in a few hundredths of a second as compared with a photoelectric response in a solid conductor, e. g. selenium, which requires several minutes. In the eye, the response-time and recovery-time intervals are the same; with photoelectric substances (solids) the recovery-time may be several minutes longer than the response-time. Like the eye some photoelectric substances, e. g. selenium, are selective in their response to thermal radiation. This observation and similar ones led philosophers to see analogies in the photoelectric cell and the eye. Recently, however, the photoelectric response in molybdenite had been found to depend upon the voltage applied to the terminals of the cell. It is, therefore, questionable whether we can compare the selectivity as to the wave-length of the rate of response with time of a photoelectric substance with that which obtains in the eye. In the gasionic photoelectric cell (substances charged to a negative potential in an evacuated chamber that lose their charge when exposed to light) the response of the negative electrode, when exposed to light, is vaguely analogous to the retina of the eye. But the spectrophotoelectric response has its maximum in the extreme violet, where the eye is quite insensitive to radiation. The sensitivity curves for light stimuli of equal energy value, as observed in photoelectric cells of calcium and rubidum and the curve of visibility of radiation of the average eye show no marked similarity. Coblenz concludes that combining the gasionic, spectrophotoelectric response with that observed in solids does not give us a composite effect which is analogous to the selectivity of the eye (1) to the rate of response, or (2) to the intensity, and (3) to the wave-length of the exciting light. Neither does persistence of vision, color of after images, etc., which obtain in the eye, have a counterpart in photoelectric sensitivity. There is, therefore, not sufficient evidence that there is a connection between phenomena of color perception and brightness perception, and the phenomena of photoelectric sensitivity of inanimate material.

Progressive visual education since birth enables us to use the distortion at the edges of large retinal images to locate an object in space, **Pech** de-

clares, this distortion forming a factor in relief vision not appreciated until now. The reflection of a photograph in a concave mirror of 80 to 100 cm. focus gives the impression of relief and the distortion of the peripheral parts of the picture is not noticed. If a photograph is projected on a concave screen produced by stretching the cloth over a frame work the sides of which are segments of hyperbolae, an impression of third dimension is had, not possible with a flat screen. The impression of relief is that of real relief, different from the stereoscopic picture which is surprisingly vivid because we are not in the habit of seeing things stand out as they do with the stereoscope.

In their observation on the course of dark adaptation in the peripheral retina, **Dresbach, Sutton** and **Burbage** used a flash method on fields of one to ten degrees situated about ten to fifteen degrees from the fovea. With the normal retina, when well adapted to daylight, the sensibility is found rising already half a minute after the light has been completely shut off. It is doubled or trebled within the first two or three minutes to be then retarded for three to six minutes with fluctuations in the threshhold. After six to ten minutes an abrupt rise begins lasting with irregularities about an hour. The rate of rise varies in different individuals and in the same individual on different occasions. Fluctuations occur during the observation that cannot be ascribed to anything else but actual changes in the sensibility of the cerebro-retinal apparatus. Regional differences in sensibility exist. The difference between the nasal and temporal sensibility in equal fields 15 degrees from the fovea may amount to as much as 60 per cent at any instant. At another time the same regions in a given individual may have the same threshhold values.

Utilizing the data obtained by Piper and Nagel in connetcion with the results of his own investigation on Mya and Ciona, **Hecht** arrives at the following conclusions as to the photochemic changes of dark adaptation: An analysis of the quantitative data describing the dark adaptation of the human eye shows that it follows the course of a biomolecular reaction. On the basis of these findings it is suggested that visual perception in dim light is conditioned by a reversible photochemic reaction involving a photosensitive substance and its two products of decomposition. Accordingly, dark adaptation depends on the course of the "dark" reaction during which the products of decomposition reunite to synthetize the original photosensitive substance.

Perception of forms is based on perception of light and darkness, **Bard** declares. On the retina a picture of the form is projected which must not be thought to be a plane image; it is a tridimensional image, since each point of the object is having its corresponding focal point, called "luminon" by the author, in the thickness of the sensory epithelium. The retinal pigment localizes and insulates the light vibrations and thus enables the nervous elements to register all the contrasts and shades of light that go to make up form vision. It is the role of the rods to maintain the representation of the different dimensions, a role to which they are fitted because they are composed of superimposed little plates. The visual purple is an apparatus to absorb and to reinforce unequally, by interference, the light of different colors. The visual purple has nothing to do with dim light vision. Colored vision may also depend on interference and diffraction of the light in the outer parts of the rods which are made up of small plates.

Instead of the three different nerve fibers postulated by the Young-Helmholtz theory, **Constentin** assumes three systems of electric resonators. These are situated in the cones which transform the luminous energy into kinetic energy and they increase this latter by resonance in such manner that the nervous current of the bipolar cells is thereby excited or modified. These resonators are tuned for certain wave lengths, but will also respond, altho less strongly, to other waves. Thus

it is not the direct effect of the different wave lengths that is perceived but only the effect of these wave lengths on the three electric resonators of the cones. From the cones the three kinds of vibrations are transmitted to the bipolar cells, most probably thru ionization. Under the influence of light the retinal pigment enters between the cones to insulate them and the cones retract from the pigment epithelium allowing the light to be reflected here and thus to produce the interference of light waves which is the cause of color sensation. The rods touch the pigment epithelium and thus do not permit reflection of light. They are to transmit only light of a certain wave length and their structure is correspondingly more simple than that of the cones. The visual purple acts as a sensitizer for the rods. Several rods are connected with one bipolar cell.

In their investigations on the relative sensibility of the average eye to light of different colors, **Coblentz** and **Emerson** found that color perception in the case of socalled color-blindness is similar to that of the normal foveal color vision under very low illumination and to that of rod vision under high illumination. The effect of light upon the color sense is quite independent of its effect upon the brightness sense. Abnormal color sense is associated with an abnormal visibility curve, but the converse is not true. Fatigue and condition of adaptation of the eye have small if any effect as to the visibility of the various parts of the spectrum. The spectral visibility-curves of no two persons are exactly alike. The cases examined can be divided about in the following manner: 20% each red sensitive, blue sensitive and average, 10% each with sensibility below the average in the red blue, and both the red and blue; one person in about 20 has a very wide visibility curve.

In place of the chemical theories of vision, **Barraquer** would have us adopt a physical theory of vision because chemical and biologic reactions cannot change so rapidly as do the retinal impressions. Light striking the rods produces a pressure which shortens them, the amount of shortening being in direct proportion to the intensity of the light and to the nervous current which is thereby produced and converted by the brain into a subjective sensation. The cones are even more contracted by light, this allowing reflection of light. Reflected and direct light lead to interference as in the color photography of Suppman. From the form of the cone produced by the light the brain deduces its color.

In their investigation on searchlight or similar illumination, **Karrer** and **Tyndall** find that contrast sensibility of the eye is of fundamental importance, that the relation of the visual angle, contrast, and field brightness for the two observers were quite similar but that for practical purposes mean values obtained from a large number of observers should be employed.

In an exhaustive paper **Parsons** subjects Edridge-Green's theories of vision to a detailed analysis. The view that the rods are not perceptive elements is shown to be untenable because birds have more numerous cones and because most reptiles and many other vertebrates have only rods. The existence of seeing animals with rods only is a negative proof against Edridge-Green's views and the fact that seeing animals exist that have cones only proves that the theory of photochemic activation of the cones by visual purple secreted by the rods is not true for these animals. Lights of low intensity appear colorless to the dark adapted eye and with increasing intensity, first the long and later the short wave lights are seen as colors; this photochromatic interval is probably entirely absent from the fovea; it is probable, therefore, that the cones are insensitive to low intensity lights in the dark adapted eye and are concerned, among other things, with color vision, and that the rods are sensitive to low intensity lights and are concerned in achromatic vision. The Purkinje phenomenon—colors of the red end of the spectrum becoming darker, those of the violet end becoming brighter with diminishing il-

lumination and increasing adaptation —supports the view that the rods are carrying on achromatic, the cones chromatic vision; absence of the phenomenon at the fovea proves that the cones do not share in achromatic vision. Other arguments in favor of the duplicity theory are derived from experiences with: Absorption of monochromatic light by the visual purple, reversed Purkinje effect, pupil reactions with colored lights in the normal and color blind and in animals, chromatic and achromatic color matches, critical frequency, total color blindness, night blindness, and from the anatomic structure and evolution of the rods and cones. It is admitted that the duplicity theory fails to account satisfactorily for all facts but it is pointed out that Edridge-Green is the only one who denies *any* light-perceiving function to the rods. Edridge-Green's view that the visual purple diffuses into the surrounding fluid and becomes distributed to every part of the outer layer of the retina, is not probable and it is more likely that, if the process is photochemical, the reaction takes place in the neuroepithelium itself; it is also improbable that the fovea should be sensitized by fluid flowing along definite channels from the surrounding areas. The light stimulus is of a photochemical nature, but judgment as to the exact details of the mechanism must be suspended. Further arguments against Edridge-Green's theory are adduced from his classification of the color blind and from his dividing the spectrum into "psycho-physical units" from his views on color mixture and the yellow sensation; his views of the independence of the luminosity and color sensations are not shared by other investigators. In detail are further discussed the evolution of the color sense, simultaneous contrasts, after image, and successive contrasts as well as varieties of color blindness. Thus many of Edridge-Green's statements are said to rest on very doubtful foundations.

In his reply to Parsons, **Edridge-Green** declares that nearly all the points raised are answered in his book, quoting the corresponding passages With the proper intensity of the light the Purkinje phenomenon can be seen with the fovea; the phenomenon is photochemical in nature and a duplex mechanism is not needed to explain it. The channels described by him in the retina are not artefacts. His views have been endorsed by Ascher of Bern. What speaks most against the duplicity theory is the statement of Burch that with complete dark adaptation there is no photochromatic interval and that colored light appeared as colored immediately it was visible as light.

The bleaching reaction of light on solutions of visual purple prepared by **Hecht** from the retina of dark adapted frogs, was irreversible and the course of decomposition followed that of a monomolecular reaction, without any measurable period of induction or after effect. He further found that the bleaching coefficient of visual purple is such as to indicate that the monomolecular course of the reaction represents a real chemical process, as opposed to a possible diffusion process, and that the reaction is probably simple in nature.

The change in the saturation of pigment colors experienced when the retina is fatigued by colored lights cannot be explained by the three color theory, **Brueckner** finds, after his experiments. It is especially unexplainable why a yellow will appear more saturated to a retina fatigued by red light or a red light more saturated when observed by a retina fatigued by yellow. But all this can easily be explained by the Hering theory.

From his experiments on the persistence of vision with the means of a flickering light and the necessary spectrometers, **Allen** arrives at the following conclusions: Whether the retina is under the influence of direct rays of light or darkness it is an abnormal condition. The change in the sensitiveness for light which is produced in the retina placed in the dark is not equal for rays of different refrangibility. The curves obtained seem to prove the duplicity theory of von Kries. Curves

from the center and from the periphery of the retina show differences as regards persistence of vision showing greater sensitiveness of the retinal periphery as regards the flickering light of all colors. To the periphery the brightest light is not yellow but green. Some of the light falling on the retinal periphery is absorbed by the visual purple and is of no service in causing vision. Fatiguing the retina with light from different portions of the spectrum, curves were obtained which prove that yellow is not a simple sensation and that three fundamental sensations exist, red, green and violet. These conclusions are greatly strengthened by his studies of natural color blindness. Persistency curves made on about 26 cases elicited 6 out of the 7 possible types of color blindness, and the curves for color blindness confirm the conclusions reached regarding the normal eye as to the number and designation of the fundamental color sensations. A white light obtained by mixing two complementary colored lights gave persistency curves different from those of a white light from an electric arc.

In an excellent review on the reactions of the retina to light, **Nutting** takes up the question from the standpoints of visibility of radiation, intensity of contrast sensibility, chromatic sensibility, rates of adaptation and absolute sensibility, in many of which chapters he has made contributions of value, giving under each heading a clear statement of what has been accomplished and often showing what conclusions applied to everyday practice can be derived therefrom. **Cobb** writes on the momentary character of ordinary visual stimuli.

His prior conception of luster, **Baumann** now defines, following on observation of luster on a dull polished armoire on which the sun shown from behind the observer, as produced by the simultaneous effect of two unequally strong but similar stimulations of the same retinal area.

Using necessary precautions to obtain photometric uniformity and to exclude the possibility of suggestion, **Loewenstein-Brill** studied the effect of strychnin injections on the adaptation of patients with normal and diminished light sense. No effect of the drug could be noticed.

Extraretinal Vision.—The book of **Farigoule** is dealt with in an annotation by the Lancet. Starting from the fact that somnambulists could, when blindfolded, perceive even written characters, Farigoule hypnotized several subjects with similar success. Experimenting on himself he finally succeeded in eliciting the same phenomena subjectively that he had found previously objectively in his subjects and was thus able to analyze and describe them in an exact manner. He believes it is unwarranted to assume that all the various forms of nerve ending in the skin have to do with the sense of touch; it is just as likely that some of them are connected with the sense of vision. Each such microscopic "ocellus" conveys the impulses received to the central nervous system. We do not see with these organs for psychologic reasons, just as the image of the squinting eye is suppressed. Some success is already claimed by Farigoule in the education of these latent faculties. In the interest of the blind, the Lancet points out, that to raise hopes in them which are doomed to disappointment, is anything but a kindness.

Subjective Phenomena.— Enumerating various entopic phenomena of perceived pulsation already described by others, **Kuemmell** describes a new one. When looking at a moderately bright surface or the blue sky and pressing on the eye ball one perceives a dark grey spot with violet hue which occasionally is more dark olive green; rythmical obscuration corresponding to the pulse can be noticed in the spot and with a certain pressure the arteries appear as dark lines for an instant with each pulse beat. The pressure exerted is rather high and eyes inclined to detachment, e.g., myopic, must not be experimented with.

Two forms of entoptic phenomena are described by **Pichler.** Both were observed with the dark adapted eyes

in the morning immediately upon awakening when light struck the eyes. The first phenomenon consists of a group of minute bright dots which at times appear yellowish or golden. They are seen in a grey background which at times has some admixture of blue or violet. The dots often seemed to jump. The sensation lasted only a few seconds and has also been observed at night upon lighting the electric light. At times the dots would form a kind of rhombic pattern. Similar observations have been described by Hess, Brueckner, Lohmann. In the other phenomenon a number of bright yellow lines ran thru the field of vision from the right above to the left below; on the right each line seemed to have a green border; between the lines were hexagonal dark grey spots. Similar reports have been made by Koenig, Hilbert.

The subjective perception of an arched bluish light round the disc and macula when the image of a feeble light is formed on the macula is not due to fluorescence, according to **Druault,** as has been claimed. He believes that the axis cylinders become luminous when in action, but this can only occur with myelinfree nerve fibers.

Erythropsia.—Reviewing the question of erythropsia, **Sheard** says that the socalled photoerythropsis is a consequence of such an unequal fatiguing of the primary color sensations, as to leave a strong red phase of the afterimage, while redvision from exposure to snow is due to fatigue of all color sensations from which the red regains its sensibiltiy first and the erythropsia following cataract extraction may be explained as due to the yellow color of the lens which shielded the retina against blue and violet.

Examination and Diagnosis.—In place of the more complicated apparatus of Vogt for the redfree fundus examination **Cantonnet** suggests a 12 volt partially inclosed globe whose light can be given the desired color by insertion of different glass screens in front of it.

Fundus After Death.—Of the dozen or more cases in which he examined the fundus after death, **Wuerdemann** reports two giving the histories and colored drawings of the fundus. Soon after death the fundus becomes a sickly yellow, the disc blanches and the arteries become straighter and less filled. Later the arteries become more empty and seem to disappear, the veins are small; irregular filamentous lines, clear spaces filled with serum appear between the blood clots. Finally the arteries are scarcely to be seen and clear spaces appear even in the veins; the yellowish fundus color becomes dirty and brownish grey, the opacity of the retina increases. The disc passes from pinkish white to yellowish green and slaty appearance. In one case reported the fundus was examined thirty minutes after death had occurred following ether anesthesia. Arteries and veins had the same color. It is thought that this may be pathognomonic of death under ether. In the other case examination was made 4 hours after death and the fundus was uniformly slaty grey and the macula showed distinctly, while the disc was discolored and the veins appeared dark and the arteries almost empty.

Pathology.—The white cloudiness of the retina in embolism of the central retinal artery is due, according to Leber, to *necrosis* of the retinal elements and to accumulation of fat granule cells but principally to *edema;* the rapid development of the opacity proving the edema: this edema is found in the inner layers of the retina, those supplied by the retinal vessels, in the recent cases and in the internuclear layer, supplied by the choriocapillaris, in the older cases. **Meinshsausen** found in the retina three days after the embolism great thickening, due to edema, of the internuclear layer and some edema in the inner nuclear layer, on the temporal side, the fovea having remained normal. In addition the choroid was greatly hyperemic on the temporal side. These changes Meinshausen explains as an edema furnished by the choriocapillaris, a collateral edema, in reaction to the ne-

crosis of the retina by the embolism; the hyperemia of the choroid in the affected region is a collateral hyperemia with accompanying chemosis. Should the occlusion be complete, edema of the inner layers can accompany these changes.

During the histologic examination of the right eye of his patient with bilateral *angiomatosis* **Erggelet** found the anterior iris surface smooth, ectropium uveae, obliterated angle of the anterior chamber and in the vitreous buds of capillaries. The retina was detached on the temporal side by an exudate and firmly adherent on the nasal side; it showed thruout absence of rods and cones, entire destruction of all nervous elements in places, glia proliferation and various sized clefts. In the nodule observed clinically the expected vascularity was somewhat wanting. The choroid showed rather few changes but the exudate between retina and choroid showed changes of impending bone formation. Histologically the picture was more that of retinitis externa exudativa and the difference between it and the clinical picture observed two years before may be attributable to the changes peculiar to the disease, to the protracted influence of the X-rays and, probably, to the mechanical changes incident to the preparation for sectioning.

Examining with the Nernst slit lamp microscope the retina of the enucleated opened eye with iridocyclitis **Vogt** could observe superficial *retinal folds,* some of which showed the double contoured preretinal reflex lines. In the histologic specimen the folds appeared about 60 micra and concerned the limitans interna and superficial nerve fibers. With redfree light he could discover residues of hemorrhages in the retina as a honey colored amorphous substance not visible under ordinary ophthalmoscopic conditions; these particles are not blood but a blood derivative.

Systematic autopsies of patients dead from kidney affections and histologic study of the kidney and retinochoroidal changes lead **Poyales** to the following conclusions: The changes in *nephritic retinal degeneration* (Leber) can be reduced to three mechanisms: toxic, vascular and mixed. The changes of toxic origin are found in chronic parenchymatous nephritis, the vascular ones in chronic nephritis and mixed ones in Bright's disease. Lesions transient and nondegenerative in character of these three types are found in some forms of diffuse acute nephritis. Intraretinal exudates lead to atrophy of the retina thru toxic and mechanic influence, extraretinal ones thru detachment and mechanic influence. The lipoids of the exudates and white patches belong to the group of phosphatids. The arteriosclerotic lesions are nearly always an expression of general disease of the vascular system. The hemorrhages occur thru diapadesis (focal) and diffuse. Albuminuric retinitis is only a form of retinal degeneration of nephritis with microscopic symptoms. The nodules in the nerve fiber layer in albuminuric retinitis are products of degeneration and disintegration (nuclei, leucocytes, accumulation of ganglion cells, lipoids, fats, etc.). Diffuse intraretinal hemorrhages may produce detachment. Dilatation of the veins mechanically disarranges the retinal elements.

The cases of *detachment with glaucoma* **Fuchs** divides into four groups: 1. The detachment is the primary. The increased tension which develops in these cases must be explained by assuming that substances producing inflammation which are given off by the posterior half of the eye are leading to occlusion of the angle of the anterior chamber. 2. Increased tension develops first; the glaucoma may be primary or more frequently secondary, caused by iris healing in a scar (adherent leucoma, staphyloma). 3. Detachment and glaucoma are caused by the same agent and one or the other may be the primary. Severe circulatory disturbances in the retina, especially thrombosis of the vein, belong here. 4. Cases where a decision is impossible which had appeared first. Histologically the anterior chamber shows typical for glaucoma and the posterior chamber and vitreous space

contain connective tissue newformations (membranes, indurations, vitreous abscesses). The detachment of the retina can be of different extent. At the disc the detached retina appears rope-like if the retinal parts are in close contact thus obliterating the vitreous space, or goblet-like if the detached retina incloses a space at the disc. These differences depend on whether the pressure in the subretinal space is greater than in the vitreous or the opposite. High pressure in the subretinal space produces a bending over of the margins of the scleral canal, abolishes the excavation and pulls the nerve fibers out of the scleral canal thru pull on the retina. As to mechanism, detachment has its cause in the preretinal space in strands, membranes, indurations, in the subretinal space in hemorrhages, exudation, and transudation. The glaucoma is produced if the anterior drainage ways are closed or when a subretinal exudate is given off under great pressure; this will of course also produce detachment. Independent of pressure conditions detachment may possibly develop in greatly enlarged eyes thru stretching.

In the histologic examination of a case of juvenile recurrent intraocular hemorrhages **Axenfeld** found true tubercles in the walls of the veins, while in other places the *tubercles* were situated in the adventitia without interfering with the lumen. The arteries were entirely free.

In his demonstration on *pathologic anatomy* of the eye, held in Madrid, **Fuchs** showed specimens of the most varied conditions of the retina from among which should be mentioned the following: In the eye of a Zulu, Fuchs found the foveal region almost as thick as the balance of the retina. In the child the retina gradually passes into the ciliary epithelium at the ora serrata, in the adult the retina ends abruptly at this point. Cystic degeneration of the retina is frequent in the old, at the anterior part and more on the temporal side. The nerve fibers of the retina acquire their myelin covering only after birth and only behind the lamina cribrosa excepting in those cases where medullated nerve fibers are found in the retina. Preretinal hemorrhages in the macular region are round everywhere except at the upper margin because of the separation of the blood into plasma and corpuscles. Subretinal hemorrhage is a hemorrhage into the retina which broke thru backward. The white spots in albuminuria are situated in the outer plexiform layer and consist of fatty degeneration of the tissues, albumin and fibrin. Albuminuric retinitis of pregnancy with detachment is a benign affection. The white spots of leucemic retinitis consist of accumulated leucocytes which also fill many of the choroidal and retinal vessels. The small foci of leucocytes in metastatic retinitis lead to suppuration of the eye. The retina is very sensitive to inflammations of the anterior part of the eye, such as wounds and ulcers, and will show purulent infiltration while the choroid may be intact. In ascending atrophy of the optic fibers the thickness of the retina diminishes from the periphery to the center, in descending atrophy from the center to the periphery. The subretinal fluid in detachment can produce irritation of the choroid and iris, leading to iritis. Cyst formation in the macula may be spontaneous or following traumatism, may lead to hole formation, and begins in the external plexiform layer. The pigment migration is not typical of pigmentary degeneration and is also found in syphilitic chorioretinitis. Detachment due to vitreous bands cannot be studied with the ophthalmoscope because of the cloudy media; in low-grade myopia the diminished pressure of the vitreous is the cause of the detachment and in choroidal tumors the pressure behind the retina; the subretinal fluid is different from the vitreous and produces an inflammation of the vitreous when injected into it. In a specimen of myopic detachment, the retina was detached everywhere except at the staphyloma posticum because there the retina was adherent to the choroid and sclera. Myopic detachment is preceded by detachment

of the vitreous; foci of inflammation, the result of irritation by the subretinal fluid, are found in the choroid, ciliary body and iris. The yellowish patches in detachment consist of pigment and fatty substance; the white lines of cholesterin crystals, all products of degeneration. In sarcoma of the choroid, the retina is lifted up by the tumor which is in contact with it; the subretinal fluid forms later, giving rise to true detachment.

The histologic examination of the eyes of a ten year old girl, **Koyanagi's** patient, who had been suffering from *hemeralopia* and xerosis of the conjunctiva during the last month of her illness, showed in frozen sections stained with sudan III fatty granules of different size situated in the outer or basal portion of the retinal pigment epithelial cells. The pigment epithelium of the ciliary body and iris showed no such changes. Other specific lipoid reactions were negative. The pigment epithelium was poorer in pigment in the posterior part of the eye than in the anterior portion and the pigment granules occupied the position found in the light adapted frog. The balance of the eyes showed no changes. It is permissible to assume that the pathologic changes in the light perceiving apparatus of the essential hemeralopia are essentially primary and degenerative as are those of the often accompanying xerosis; in the hemeralopia the lipoid substance appears first in the pigment epithelium, in xerosis in the superficial epithelium of the conjunctiva. The whitish fundus described by Oguchi, Augstein and others may be an expression of advanced lipoid formation. The cholemia caused by the cirrhosis of which the patient had died, is not to be blamed for the hemeralopia.

To the 13 cases of *tuberculosis* of the retina examined histologically, **Fuchs** adds two of his own. In the first case the eye of the 55 year old patient had been enucleated because of chronic iridocyclitis and glaucoma. The ciliary body contained several nodules consisting of epithelioid cells with central giant cells and only a trace of a lymphoid cell mantle. Because of these typical tubercles the small foci in the retina consisting only of epithelioid cells are looked upon as similar conditions. The larger retinal vessels were normal and the location of the nodules in the inner nuclear layer points to the capillaries as the point of invasion of bacilli. The case is summed up thus: Retinal hemorrhage of unknown origin leading to connective tissue formation on the retina and to toxic inflammation of the iris which producing glaucoma caused circulatory disturbance in the retina and thereby accumulation of tubercle bacilli from the circulation. In the second case, that of a boy whose right eye had been removed because of glioma suspicion, the retina was thickened and detached. Tubercles were very numerous in the retina and fewer in the uvea, while the iris was entirely free of them. Simultaneous invasion of retina and uvea is assumed. The toxins from the bacilli produced an inflammatory exudate on the inner surface of the retina which in shrinking, led to detachment of the retina; they also produced the iritis but could not attack the ciliary body because of its double epithelial covering.

From a study of his own specimens of colobomatous eyes from the rabbit and from an infant, and from a review of the literature, **Van Duyse** arrives at the following conclusions regarding *gliosis* found in these conditions and what these findings teach as regards angiomatosis of the retina: In the palpebral and orbital cysts of microphthalmic and colobomatous eyes gliosis of various appearance is found: it may appear like an epithelial tumor or like one of spindle or fibrous tissue, or the cells may assume characteristic ependyma arrangement. The hyperplastic tissue may fill the cyst, may project into the cavity in the form of buttons, or may develop in the form of nodules within the inverted retina itself with thickened supporting tissue and sclerosed vessels. A parallelism exists between the gliosis of the retinal cysts and the angiogliomatosis of the retina, justifying the view of a

congenital basis of this disease. The differences in the conceptions of von Hippel's disease are based in the predominating role taken by the different tissues. **Guzman** reports a diffuse gliosis of the retina.

The histologic report of his specimen promised by **Crigler** (Y. B. 16, p. 168) is now published as one of *Coats' Disease.* The iris showed marked ectropium produced by a membrane on its anterior surface, the choroid was atrophic and the retina totally detached. On the free inner surface of the choroid were several tabs of tissue from 1 to 3 mm. in diameter composed of fibroblasts extending into areas of granular debris with fibrin and cholesterin. In the retina the outer layers had disappeared and the inner layers were markedly thicker and showed an increased number of vessels which were generally dilated and thin, many containing thrombi. Some vessels showed aneurismal dilatations, others thickened walls. Hemorrhages and cholesterin were found in places; ampulliform dilatations on some capillaries. Fibrin, fibroblasts and round cells extended into the vitreous in loop formation. The case is remarkable for the absence of masses of fibrous tissue between retina and choroid.

Photophobia.—To help settle the question of pain produced by bright light (photophobia), **Siegwart** studied the problem on a large number of patients, made experiments and arrived at the conclusions that without a functioning retina no pain is experienced when the eye is exposed to light; without a functioning retina there is no pupillary reaction. His experiments with ultrared confirm the view of Nagel that the pain is mainly depending on the reaction of the pupil.

Solar Retinitis and Ring Scotoma.—During the solar eclipse in 1912, the patient of **Jess** watched the sun with unprotected eyes for about fifteen minutes which resulted in lowering the vision of each eye. During the six years following vision became even worse and the eyes tired easily. Ordinary ophthalmoscopic examination showed no positive changes but with the redfree light a minute sharply defined, brownish defect in the yellow macula could be seen. That the whole retina had suffered, not the macula alone, was evident from the fact that the worse eye, the right one, recognized only red, while the left one saw only red and blue, and from the marked disturbance of the adaptation and the hemeralopic symptoms. On one occasion exposure to bright sunlight reflected by a snow covered field produced a paracentral scotoma of short duration. All this is quoted in evidence that the neuroepithelium of the retina and not the nerve fibers, had been injured during the eclipse.

Since his report (Y. B. 1916, p. 214, 248) on ring scotoma in flyers, the number of patients examined by **Zade** has increased to 400; of these 103 were flyers and 297 persons employed in antiaircraft service. 92% of the flyers showed the peripheral ring scotoma, 45% of the others. The conditions found in the first series are identical with those elicited since; remarkably frequent were the scotomas situated about 50 degrees from the fixation point. Similar scotomas were found in all seven linemen examined who were employed in locating the trouble in the telephone wires; this scotoma is due to the fact that they continually face the bright sky while searching for the defective wire. The scotoma in the flyers comes only after four weeks of flying; those wearing colored glasses remain well. Two views as to the mode of development of the scotoma are considered: the one based on the anatomy of the choroidal vessels and the other placing the disturbance in the nerve fiber layer; neither is satisfactory and the problem is still unsolved.

Snow Blindness.—From his experiences in the Antarctic, in France and in Russia, **Atkinson** describes two forms of snow blindness: In the first form characterized by lacrimation, photophobia, chemosis, corneal ulcers, hyperemia of the retina and blurring of color vision, the affection is due to exposure to excessively strong illumination by the sun and reflection and refraction of the light by the snow crys-

tals and is mainly the effect of the violet end of the spectrum. In the second form a diplopia lasting several days probably due to tiring of the eye muscles thru lack of contrast occurs. Both forms can be prevented by wearing glasses eliminating light from the violet end of the spectrum; amber or red glasses will give more efficient contrasts. The different samples of colored glass have to be examined for their protective qualities. Adrenalin instillations are very efficient treatment.

Visual Fatigue.—Fatigue of the retina and visual centers is of more importance than all other forms of fatigue connected with vision, **Jackson** declares. We cannot discriminate between fatigue of the retina and that of the intracranial neuron. Fatigue is attended with lowered visual acuity as is observed when eyes are being tested. The maximum of resolving power quickly drops, reaching a level where little change is noted for a long time. Age, exposure to light, disease influence the change in visual acuity. The process is closely associated with adaptation and from this the retinal nature of this form of fatigue may be concluded. Closely related to the matter of lowered visual acuity is the fatigue significance of after images. In testing color and night vision more attention must be paid to adaptation and elimination of after images. Strong contrasts are fatiguing. This is of importance because the resolving power of the eye depends on sharpness of contrasts. A compromise must be sought giving an optimum of efficiency for the eyes; illumination of the page, color of the background and illumination of the room, all have to be considered. In the matter of fatigue the question of coordination is also of importance. Analysis of the different forms of fatigue will be useful in giving a better conception of the measures to be adopted. **Dietz** considers the subject of colored after images, and **Hardy** writes on the persistence of vision.

Cinematograph Irritation.—From his observations on the discomfort produced by watching moving pictures, **Wilson** arrives at the conclusion that the seat of the discomfort is in the retina, that in dark adaptation the retina is more senstive to dim light and resenting flashes of light and illdefined images. Dark adaptation seems to be one of the objectionable conditions. Illumination of the hall during intervals is desirable; the pictures should be steady; dissolving pictures and those with strong lights on white objects are to be avoided. He has seen no disease following cinematograph irritation.

Hemeralopia and Adaptation.—In an annotation on Nyctalopia or Hemeralopia, the British Medical Journal comments on the fact that at present we speak of hemeralopia when we mean night blindness. But hemeralopia has been used for nyctalopia or night vision. Nyctalopia should be used for night blindness and hemeralopia for better vision at night. Nyctalopia as used by Hippocrates means to see at night, but later classical writings defined it as inability to see at night. A supposed omission in the copying of the manuscripts is blamed for all the confusion and the Journal thinks it might be best to give up the use of both terms altogether. **Kammerer** writes on adaptation in light and dark.

In answer to the remarks of the British Medical Journal on the terms "nyctalopia" and "hemeralopia," **Fletcher** adduces quotations from early writers to prove that the uncertainty as to the meaning of nyctalopia arose before the Middle Ages. Nyctalopia in the sense of night blindness has been used by Aristole, Pliny, Celsus, etc. The ambiguity of meaning even extended to the Latin term "luscitio."

The visual purple, a lipoid secreted by the retinal pigment cells but originating in the liver according to **Oguchi** is by him brought into causative relation to hemeralopia. Kumagai's experiment of extirpating the liver and ligating of the liver veins and the supposed delayed return of the alkalinity of the retina is quoted in proof of his theory. The visual purple is either quickly used up or it is slowly re-

placed. This is his classification: (a) In the dazzling hemeralopia the visual purple is rapidly destroyed; (b) delay in the replacement of the visual purple occurs with insufficient food, especially fat hunger, diminished blood assimilation thru intestinal affections, liver diseases, obstacles in the biliary passages, blood disease and intoxications which destroy the lipoid in the blood stream, and overwork where the lipoid is destroyed thru the muscular activity. These two causes produce idiopathic hemeralopia. (c) Retinal and choroidal affections. (d) Disturbed function of the epithelial cells as in congenital hemeralopia.

Three hundred and twenty cases of night blindness among soldiers were found by **Tricoire.** He ascribes it to a lack of vitamins, as all the men threw it off promptly under cod liver oil.

Among the 109 patients from the Bhowra Colliery, India, treated for hook worm disease, **Lal** found eight who suffered from night blindness before treatment and all recovered from the night blindness completely two or three days after the first administration of thymol.

In his paper on Tropical Ophthalmology **Terrien** discusses filaria, hemeralopia and toxic amblyopia.

Two epidemics of hemeralopia were observed by **Gonzalez** among the children in an asylum at Leon. Good results were obtained thru feeding of fresh sheep and ox liver after other treatment had failed. From this Gonzalez concludes that the liver contains hormones which stimulate the production of the visual purple which is essential to the twilight vision. Essential hemeralopia is the result of hypofunction of the liver.

With his improvised adaptometer, **Wiese** examined 105 hemeralopes at the Eastern front. The adaptation of the examined was checked against that of a person with known adaptation curve, because no absolute measure of the sensation exists. The general results are similar to those of other authors. Variation in the yellow and the blue curves was especially noticeable. 10 times color sense defects were discovered. Myopia was found 52 times, hyperopia 16 and mixed astigmatism 8 times. There must therefore exist a certain relation between hemeralopia and errors of refraction. Cloudiness of the media was found 31 times, the same number with affections of the light perceiving structures. Typical pigmentary degeneration was found twice and some severe general disturbance was discovered in several instances. Hemeralopia caused by the war conditions does not exist, but the hemeralopia often becomes manifest under these conditions, since in all cases objective symptoms in the eye or in the general health could be found to explain the hemeralopia. Treatment with cod liver oil, etc., is therefore useless. The affected are to be employed under proper service conditions. See also Koyanagi, under Pathology; Jess, under Solar Retinitis; Wilson, under Cinematograph irritation.

HEMERALOPIA AND SCURVY.—During his four years' stay in Siberia as a prisoner of war, **Meissner** observed epidemics of scurvy and hemeralopia. Poor hygienic conditions and limited diet were the rule. He believes that scurvy and hemeralopia form one symptom complex and that the two are only manifestations of a quantitative difference: the stronger, more resisting organisms will show hemeralopia, weaker individuals will show scurvy. Separate war hemeralopia exists. Mixed diet and cod liver oil produce cure. Hemorrhages in the lids and conjunctiva were found in scurvy but no xerosis of the conjunctiva in hemeralopia.

Among the crew of a long delayed sailing vessel **Aitken** found a cabin boy with night blindness and a seaman with bleeding gums, while most of the balance were feeling ill. All improved on fresh vegetables and lemons. **Hampel** writes on the cure of hemeralopia.

CIRCULATION.—Admitting that his dynamometer can and ought to be improved **Bailliart** adduces the testimony of instrument makers that a well made spring is perfectly reliable and his apparatus is calibrated in grammes which will allow easy checking up. Tho

the scale is somewhat difficult to read and the instrument somewhat cumbersome, the dynamometer is still perfectly utilizable and reliable. Sufficient ophthalmoscopic magnification, pressure with the apparatus made evenly and pressure exerted noted in figures are necessary conditions if the results of different examiners are to be comparable. The electric ophthalmoscope for the direct method is necessary; anesthesia is not always necessary, but holocain is advisable; no cocain. He uses homatropin only in cases of real miosis. He admits that it is wrong to believe that the retinal arterial pressure is exactly equal to the intraocular tension plus the pressure exerted on the eyeball which makes arterial pulsation appear and disappear. The pressure of the dynamometer changes the scleral and corneal curvatures and thus also the surface of contact for the tonometer (Schiötz). His table of retinal arterial pressures when the original intraocular pressure is known gives no absolutely exact figures; nor are his and Magitot's results, from experiments on the cat, absolutely correct. In practice it is, therefore, sufficient simply to note the dynamometric pressures and (under normal intraocular tension) any change from the figures for the normal individual of 25 for the minimal and 60 to 70 for the maximal pressure will at once indicate a change in the retinal arterial pressure. The dynamometric pressures and the initial intraocular tension need only be recorded. To measure the brachial pressure and to allow 20 mm. for the difference in level between brachial and retinal arterial pressures, as Duverger and Barré suggest, does not give the correct results. The retinal arterial pressure is often different in the two eyes of the examined. The intraocular tension is not influenced by the retinal arterial pressure but in the normal a certain parallelism between the two seems to exist. With increased intraocular tension there is generally at least an increase of the minimal arterial pressure.

Five and a half hours after taking 4 grammes of a quinin salt to induce the menses, **Bollack's** patient, aged 26 years, noticed the onset of rapidly oncoming complete blindness. Vomiting and buzzing of the ears accompanied it. Maximal dilatation and immobility of the pupils were noticed a few hours later. Nine hours after onset of blindness discs were pale but arteries and veins were apparently normal; six hours later sight of the right eye and pupillary action began to return and 33 hours after the beginning of the amaurosis vision and the discs had become normal. Two months later both discs were pale tho vessels and vision were normal. During the amaurosis transitory hypertension in the retinal arteries was noticed according to Bailliart's method, during the same time as the pallor of the discs. Both are explained as due to slight contraction of the small retinal arteries. The lesions of the retinal ganglion cells and of the nerve fibers might be due to prolonged vasoconstriction. The secondary pallor of the discs noticed two months later is due to degenerated nerve fibers.

In a patient with a foreign body in the cornea, examination of the retinal circulation by **Nunez** showed a very low minimal and high maximal pressure. This was also found in the general circulation which led to the discovery of aortic insufficiency underlying both conditions. **Abelsdorf** writes on the circulation of blood in the eye; **Binniefeld** on the difference of circulation in the eyes in light and dark.

Spontaneous venous pulsation was found by **Wiart** in 37% of the eyes examined. If the difference between the intraocular tension and the intravenous pressure is very great, no venous pulse occurs; but if the two are very near equal, then the slightest change may produce venous pulsation. Spontaneous pulse occurs, therefore, if intraocular tension and venous pressure are very near equal. If the venous pressure is greater than the intraocular tension, slight pressure on the eye, as with the dynamometer, may bring about venous pulse. If the intraocular tension is greater than the venous pressure, no venous pulse can be

artificially provoked. From his experiments, Wiart concludes that in about one-sixth of the patients intraocular tension and venous pressure are equal and in the other cases intraocular tension is one time higher and another time lower than the venous pressure.

Angiosclerosis.—Marked arteriosclerotic changes in the fundus vessels and newformed vessels over both discs, were seen in **Finnoff's** patient, a man aged 70 years, together with three apparently venous aneurisms along the upper temporal vein of the left eye, between two of which ran small vessels probably representing collateral circulation.

The arteriosclerotic changes in the left eye of **Bane's** patient, a man aged 56 years, showed as a web newly formed, bright red vessels, concealing the disc and extending upward from above the center of the disc for two d.d., having the same extent laterally; in addition the inferior temporal vein curved sharply twice about two d.d. below the center of the fundus and then projected forward into the vitreous like remains of the hyaloid artery. Urine contained albumin and sugar. **Dutoit** writes on the fundus oculi and arteriosclerosis.

Occlusion of the Artery.—After two years of attacks of momentary blindness, the patient of **Eigler** with obstruction of the central artery, a man aged 42 years, experienced sudden blindness of his left eye which lasted 24 hours after which time sight began to improve. In the discussion Jackson suggested that the condition had been one of spasm.

In a man aged 45 years who three months before had suffered slight hemiplegia with difficulty of speech, **Cross** found, during examination of the otherwise normal left fundus, a sudden break in the descending temporal artery resembling the separation of the mercury in the thermometer. This appeared as a blanching of the artery and was first observed on the disc and slowly moved over the edge, increasing until it was about one d.d. long; after a pause the empty area suddenly moved forward. The progression was slow and uninterrupted until a bifurcation was reached and continued in each branch of the bifurcation until it disappeared in the periphery. While the vessel was empty of the blood there was no apparent change in caliber, it looked like an empty cylinder with no collapse or dent. In the discussion Schwenk alluded to the case of Harlan in which the retinal vessels were empty and invisible, while Holloway mentioned a patient under his observation with obscurations occurring every ten days for many months, and insisted that spasm of the vessel could not be excluded, alluding to Raynaud's disease, trench foot, etc.

Occlusion of the macular artery by endarteritis in a man, aged 23, whose vision of the right eye suddenly became blurred five weeks before is reported by **Peter.** An opaque grey area on the outer side of the disc including the macula was seen. The macular twig was completely occluded; the disc was hazy, the veins in the periphery were dilated and tortuous. Fluffy, white masses floated in the vitreous. The Wassermann was positive. Later, deposits on the Descemet were visible. A central scotoma and an enlarged blind spot for red and green; a larger scotomatous area for blue included macula and blind spot. The scotoma for blue and the greater contraction for the blue field point to an involvement of the choroid, producing a disturbance of the neuroepithelium.

Embolism.—Referring to a paper on the same subject published in 1906, **Wuerdemann** reports a case of embolism of the central artery in a man aged 70 years seen a few hours after his right eye had suddenly become blind. Large objects were seen on the temporal side, but the pupil showed no light reaction while it reacted to accommodation. The disc was blanched, arteries and veins were nearly empty and no cherry spot existed in the macula owing to the early stage. Immediate deep digital massage and suction with the pneumatic pump were used for half an hour and the disc red-

dened, the vessels filled and the field enlarged. The large central scotoma became smaller during the next two weeks and the pupillary reaction returned.

About two hours after embolism occurred in the right eye of his patient, a woman aged 28 years, **Bell** made paracentesis of cornea. The macula appeared as a cherry red spot in the white cloudy opacity which extended over the entire fundus; the vessels were small and the disc looked pale; tho light perception existed the pupil did not react to light. After paracentesis massage and nitroglycerin were used. Two months later the fundus had normal color, the disc was atrophic and the pupil again reacted to light.

The case of embolism of the central artery of the left eye of a man aged 21 years, with acute rheumatism and endocarditis, the patient of **Laval** and **Masselin**, presented several interesting features: in several veins the blood column appeared fragmented and the particles moved back and forth, which is explained as due to the periodic aspiration of the blood during the diastole. On the disc a dilated vessel looked like a hemorrhage. Compression of the globe produced pulsation only in the wide part of the artery not in the empty one. See also Meinshausen, under Pathology.

Thrombosis of the Vein.—Two cases of thrombosis of the retinal veins after influenza are reported by **Jackson.** One month after an attack of severe influenza a woman aged 59 years found the sight of her right eye suddenly dim. One month later Jackson found the vision of the right = 0.006 eccentric, although the sight had grown better in the last days. Arteries were rather pale with broad light streak, the veins of irregular caliber and slightly obscured at some crossings. In the macula was a large hemorrhage of two and a half disc diameters, round. More than the upper half of it had been absorbed; the original border of it showed as a light greyish line, apparently no reflex. Near the upper temporal border of this hemorrhage was a smaller, round one, both apparently subhyaloid. Several other hemorrhages, especially in the distribution of the lower macular vein which appeared large and tortuous. White spots at the lateral margins of the large hemorrhage. The hemorrhages became absorbed with vision normal and about 50 white dots showed in the region of the large hemorrhage. Case 2. A woman, aged 33 years noticed blurred vision during an attack of influenza. Two months later vision of the affected left eye was 0.3 and the fundus showed an area of moderate haziness, swelling and striation extending from above the disc to and including the fovea. The area was sharply limited and contained flame-shaped hemorrhages, white spots and tortuous dilated veins; the fovea showed as a darker red spot. This produced a relative scotoma. The fundus became normal and vision 1.1 with some hesitation. By the internist influenza is classed close to typhoid and the puerperal state in its general tendency to cause thrombosis of the large blood vessels. The obstruction of the retinal vein is usually not complete and the prognosis of retinal hemorrhage from venous thrombosis due to influenza is therefore more favorable.

Thrombosis of the central artery in a woman aged 52 years, with chronic parenchymatous nephritis, who suddenly lost the sight of her left eye 24 hours before was observed by **Strickler.** The disc was normal, the vessels showed signs of sclerosis and the upper retinal artery appeared as a white streak for some distance above the disc; a two d.d. hemorrhage was seen above and to nasal side of the disc. The pupil did not react to light, but reacted consensually. Ten days later the disc appeared swollen, the retina cloudy and a rectangular red spot in the macula with several small ones near the disc were seen.

Thrombosis of the central vein was found by **Bell** in the left eye of a man aged 32 with diabetes. An almost continuous sheet of blood extended over the disc and to the temporal side. The veins were enormously distended and buried in the swollen retina. Two months later some hemorrhages were

gone, having left behind white areas, and fine new vessels were seen on the disc.

Vision failed suddenly in the right eye of **Brearley's** patient, aged 23 years, and the picture was that of venous thrombosis. Physical examination and Wassermann were negative. Nine months later there appeared a fan-shaped structure coming forward from the disc above and below, vessels branching as in the mesentery, with fine connecting loops at the extremities. These shrank up to the condition of the date of demonstration and the fundus lesions cleared up.

Called upon for an expert opinion whether unilateral thrombosis of the central retinal vein could be standing in any causative relation to an attack of dysentery and a possible attack of malaria two and a half years before, **Junius** decided that, tho thrombosis of the retinal vein does occur without any discoverable lesion of the whole vascular system, tho thrombosis is not a part of the picture of dysentery and tho retinal hemorrhages of malarial origin are rather benign, such causative relation cannot with certainty be denied and that at most a partial compensation should be paid owing to the factor of predisposition.

In a collective paper on circulatory disturbances of the eye **Ischreyt** relates the cases from his experience grouped in the following manner: 1. Embolism of the central retinal artery. Of this condition he observed five cases, but whether a true embolism occurred cannot, he admits, be stated positively because they had been observed only clinically. Two of these cases came to an early death by apoplexy and embolism must therefor, be looked upon as a prognostically unfavorable occurrence. In another case bilateral embolism occurred in a patient several days after an operation on the stomach and the embolism may possibly have been dependent on some changes in the field of operation. 2. Metastasis. Two cases are mentioned of metastatic purulent inflammation of the eye under the assumption that invasion had occurred in the posterior part of the eye or in the retina. 3. Orbital inflammations leading to visual disturbances, three cases. 4. Thrombosis of the central retinal vein. In his ten cases, the thrombosis recurred several times in three, none of these developing secondary glaucoma. In one case the thrombosis was complicated by occlusion of the central artery and the accompanying dacryocystitis is considered the possible cause for the trouble in both vessels. In one case visual disturbance occurred with the ophthalmoscopic picture of neuritis and retinal hemorrhages, no cause for which could be found. In three cases thrombosis occurred in eyes with primary glaucoma; in one of these it could not be established which of the two conditions had preceded. As to the question whether hemorrhagic glaucoma should be considered a primary or a secondary one, he finds among his 136 eyes with primary glaucoma only two with venous thrombosis. His sections of 23 eyes with glaucoma showed that even in such unfavorable and far advanced cases thrombosis of the vein is rather rare in primary glaucoma. Glaucoma as such has, therefore, no essential influence in producing thrombosis. **Scheerer** discusses disease of the blood vessels of the eye.

Aneurism.—In a man, aged 54, whose left eye had been failing for six weeks, **Fernandez** found vision of the affected eye fingers at two meters and many aneurisms in retinal arteries, more in the upper branches. Near some were hemorrhagic zones and in two places small atrophic areas, apparently different phases of the same process. Because of the high arterial tension and the general arteriosclerosis the prognosis was pronounced serious. This was borne out by the patient's death forty days later. See also: Suker, under Pathology; Finnoff, under Angiosclerosis.

Peripheral Communicating Vessels Between Choroid and Retina.—In the report of four instances of peripheral communicating vessels between choroid and retina observed by him, **Feingold** completes the literature

of the affection by the mention of three plates in the supplement to Oeller's Atlas. In the first case the condition developed in the left eye of a boy after a perforating injury by a B.B. shot and the large vein coming from above was distintly seen suddenly to end 3 d.d. above the disc in the center of a patch of pigment the seat of the perforation: a thin white line marked the original continuation of the vessel toward the disc. See Plate 1, Fig. 1.

In Case 2, a vein coming from the upper temporal periphery of the right eye of a woman, aged 46, ended about 4 d.d. from the disc suddenly in the center of a pigmented patch of chorioretinal atrophy and its continuation towards the disc could not be traced. Lues was probable in this case. The third and fourth instances were found near the posterior pole in each eye of a young girl, aged 18, whose physical examination was negative. In each eye a large vein with angular bends arriving from the temporal periphery gradually getting wider, made a sharp turn upward and disappeared in the center of a patch of black pigment near the posterior pole. In each eye, from the sharp bend, a very fine reddish line was seen to run toward the lower temporal vein marking the original communication between the vessel and the lower temporal vein. Cases I and II are to be classed in Group II of Leber in which no communication exists between the vessel and the disc; the third and fourth instances are forming a transition between Leber's first and second groups, since in each a fine hair-like vessel was seen to connect the anomalous vessels with the lower temporal veins.

In the right eye of the third case there was seen in addition a thin white glassy line parallel with the nasal half of the disc, lying in front of the vessels and accompanied by a similarly thin red line which changed position in relation to the white one with the direction of the light of the ophthalmoscope. No parallactic displacement could be observed and the white line is interpreted as a fold of the inner limiting membrane in consequence of traction on the retina from shrinking. The red line is interpreted as a shadow, colored red, because of the fundus surroundings. A similar white line with an accompanying red one forming an almost complete circle around the disc was found in a case of old central chorioretinitis. See Plate II, Fig. 2, which should be looked at with the name of the artist to the left side, to give the structures in their proper relation. See also Peter under Proliferating Retinitis.

In a girl of 18 years whose right eye had been bad since measles at the age of eight, **Gradle** found a sharply defined, circular, irregularly pigmented area of old retinochoroiditis in the macula about twice the size of the disc. Above this area was a small white one of retinochoroiditis between two normal vessels and surrounded by hyperemic retina. This was undoubtedly an area of acute inflammation. To the temporal side of the macular area and slightly above was a smaller lobulated area of pigmented retinochoroiditis, closely resembling the larger central area, showing serrated edges and irregularly clumped pigment and pure white center. Three small veins from the temporal periphery converged towards this area uniting to form one fair sized vein about 3 d.d. away from it. The vein crossed the focus on the lower temporal border and headed for the clear central pigmentfree area where it bent sharply downward and disappeared. At the lower nasal margin of the focus another vein resulting from a confluence of two small veins disappeared between two lobulations of the edge and did not pass on to the center but apparently was also a communicating vessel. The left eye showed early albuminuric retinitis with extensive exudation. Wassermann was negative, but urine showed albumin and casts.

In a very readable general paper **Woodruff** describes to the general practitioner and internist the changes in the retinal vessels and retina in systemic disease.

Angiomatosis.—In the right eye of

a man, aged 39, **Clausen** found the typical picture of angiomatosis on the temporal side of the disc. On the surface of a moderately projecting exudation, resembling Coats' disease, were found numerous vessel convolutions and sausage-like vascular formations; at the edge of the exudation fine glia proliferation and beginning vascular convolutions and nodules could be seen. In the neighborhood the pigment epithelium appeared greatly destroyed and the choroidal vessels much enlarged. According to the clinical picture angiomatosis is the primary thing and gliosis is only a secondary feature.

Angiomatosis was the cause of failing vision of the left eye of **Erggelet's** patient, a girl who had rapidly lost the sight of her right eye two years before from the same cause. In the left eye a large protruding red nodule in the upper temporal part could be seen to which two greatly enlarged and tortuous vessels extended; in the macula was a complete star figure. In the rest of the fundus, except the upper nasal quadrant which appeared entirely unaffected, were seen white spots and areas. X-Ray treatment was of no benefit, vision continued to fail during the next three years and increased tension necessitated an iridectomy. In the right eye the completely detached retina contained dark red tortuous and irregularly thick vessels. A small bright red nodule showed with the Nernst slit lamp a fine coat of fine white behind which an occasional vessel loop could be seen, thus producing the impression of a kidney glomerulus. Behind the retina opaque fine granules were noticeable. Cataract developed followed by glaucoma which compelled enucleation. (See under Pathology.)

In the left almost totally blind eye affected about one year of a young man, aged 16, **Gourfein-Welt** found on the temporal side of the normal disc a large white focus crossed by an artery; the upper part of the focus appeared like a thick stretched membrane, the lower part folded and fluctuating. A short distance from the disc the artery became thick, tortuous and disappeared in a fold of detached temporal retina. Vitreous hemorrhages and glaucoma necessitated enucleation fifteen months later. The right eye was normal except for a sharply defined small deep red focus in the macula, an angioma. Histologic examination of the left eye revealed a small angioma that had not been seen ophthalmologically. The two eyes presented, therefore, different stages of angiomatosis, in the left one the end stages under the clinical picture of exudative retinitis. Gourfein-Welt believes that the exudative retinitis of Coats represents only the last stage of a unilateral angiomatosis; other affections as Leber's retinal degeneration thru multiple miliary aneurisms and possibly certain injuries might produce the picture of exudative retinitis if bleeding in the outer layers occur.

To the two instances of familial occurrence of angiomatosis found in the literature, **Tresling** adds another one observed in two brothers aged 27 and 25 years whose third brother had epilepsy and choked discs, the cause of which could not be found in spite of craniotomy. In both instances the left eye was the affected one and the trouble was said to have existed only one week. In the eye of the older brother several small white foci and hemorrhages were seen at the disc and in the macula. In the upper and in the lower fundus each an artery and a vein became dilated and tortuous after which they both entered a large red nodule. In the eye of the other brother a white focus began at the upper disc margin and extended into the nasal periphery; white foci were seen in the macula and one very large grey-white area in the upper temporal fundus; in the region of the latter focus an artery and the corresponding vein became tortuous and dilated and entered a sharply outlined red nodule beyond it. Physical examination and Wassermann reaction were negative in both brothers. See also Van Duyse, under Pathology.

HEMORRHAGE.—Of the intraocular affections in grip, hemorrhagic condi-

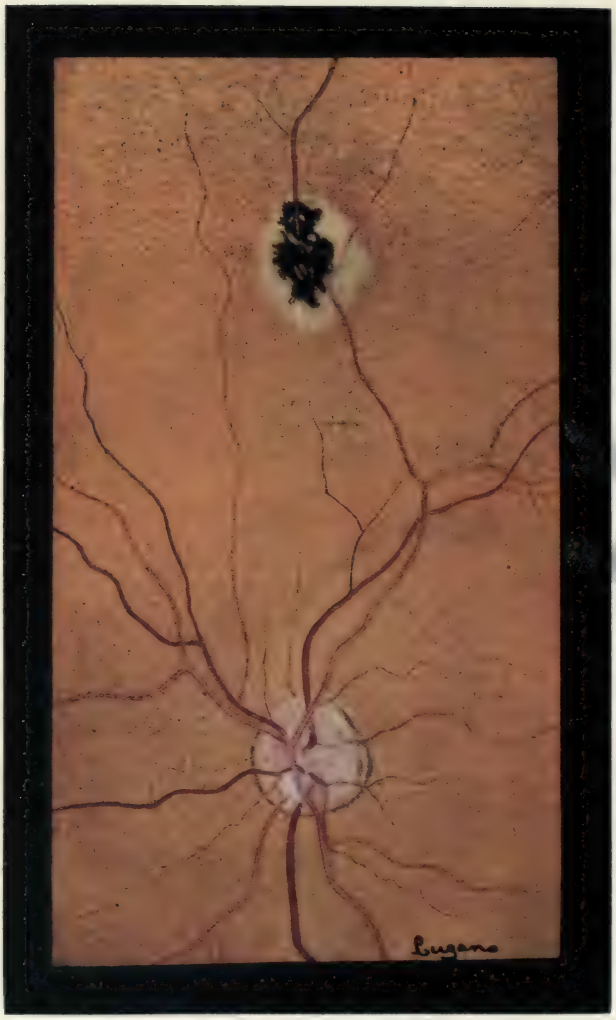

FIG 1. PERIPHERAL COMMUNICATING VESSEL BETWEEN CHOROID AND RETINA. (FEINGOLD). SEE SECTION ON THE RETINA.

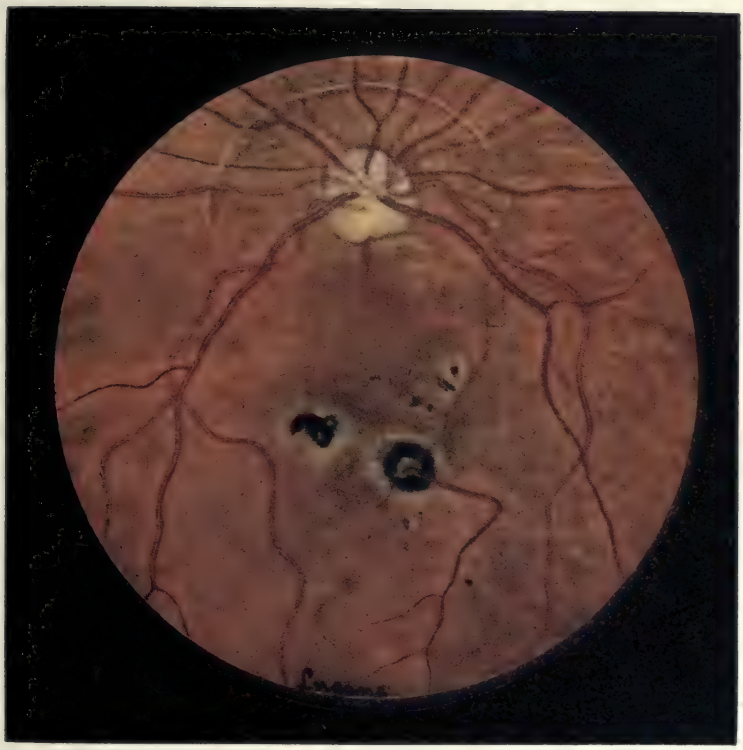

FIG. 2. PERIPHERAL COMMUNICATING VESSEL BETWEEN CHOROID AND RETINA AND FOLD OF INNER LIMITING MEMBRANE OF RETINA. (FEINGOLD).

tions were noticed most frequently by **Fraenkel.** The hemorrhages were in the vitreous, either alone or accompanied by retinal hemorrhages. The retinal hemorrhages were unusually frequent near or on the disc. Occasionally small white foci in the inner layers of the retina were found.

Peripapillary hemorrhage in the highly myopic eye of a woman was reported by **Marbaix** with the subjective changes during resorption of the hemorrhage.

In a series of hemorrhagic retinitis cases, **de Waele** found the blood pressure generally increased. The vascular hyperpressure, tho an important element, is not the exclusive etiologic factor of retinal hemorrhage; the composition of the blood plays an important part in the etiology, especially in uremia and cholesterinemia.

In reporting four cases of recurrent retinal hemorrhage, **Zentmayer** enumerates the characteristics described by Eales who gave to the disease the name. Three of these patients were males, two of these being 18 and 23, the fourth patient was a female aged 33 years. In all four the Wassermann was negative; in two the tuberculin test was positive, in one negative and in one not recorded. Blood pressure was normal in all. Coagulation time was normal in two, slow in two; hemoglobin was below normal in all. The repeated hemorrhages into the vitreous and retina made inspection of the fundus often impossible; detachment of the retina in one eye ultimately occurred in two patients, while proliferating tissue is recorded in all four cases. Vision showed the usual fluctuations in the individual cases. One patient seemed improved under tuberculin. In view of the symptoms of asthenia such as lassitude, low spirits, cold hands and feet and in view of the tendency to over size in his three cases and the beneficial effect of thyroid in some instances, Zentmayer, after a thoro review of the literature, ventures the opinion that disturbed secretion of some of the ductless glands may be an important etiologic factor. He does not wholly reject the tuberculous cause of the disease but believes that in the adrenals, whether independent or in conjunction with tuberculosis, may be found the other factor to explain the striking characteristics of these cases.

Referring to a case published by him some time ago (Y. B., 1912, p. 237), **Davis** reports a new case of recurrent hemorrhage in a man aged 19 years who one year before had suddenly lost the sight of the left eye. Five days after the onset of the disease the right eye showed greatly enlarged and tortuous retinal veins and edema in the macula with chorioretinitis about the retinal veins. In the left eye the disc was elevated about 3 D. and pronounced choroidal changes were seen along the blood vessels; in retina and vitreous were connective tissue bands with blood vessels in them; the retina was detached in the periphery. Choroidal atrophy existed near the disc and in the periphery. Old tuberculin injection was followed by temperature, local and focal reaction with slight improvement but detachment in the lower half of each retina and proliferating retinitis in the periphery of the right eye developed later. At this stage fingers were seen excentrically at one foot with the right eye and the left one had only light perception. Later trephining on the right eye brought about reattachment of the retina and clearing of the vitreous; but detachment occured four months later. Renewed trephining and cauterization at the openings was without result. His first case Davis classes under the type described by Siegrist in which the peripheral vessels are more involved, the second case comes under the type of optic nerve and central vein involvement.

Of a total of fifteen patients with intraocular hemorrhages of the adolescent which **Aubineau** observed, five were at the same time in the military hospital. Of these five Aubineau tried the antihemorrhagic effect of provoked serum anaphylaxis as advocated by Dufour and Brow (1914) and Dufour and Le Hello (1919), who suggested injections of blood from a rabbit in the state of anaphylaxis, called

"serum-serine"; but instead of this Aubineau used antidiphtheritic serum. The patients were sensitized by a subcutaneous injection and ten to fifteen days later attempts were made to produce anaphylactic symptoms thru subconjunctival or subcutaneous injections. In three cases no effect was obtained, in one case local and general symptoms followed without any result and in one the result was surprisingly successful. This last case was that of a man aged 21 with vision R.E. 1/100, L.E. Perception of light, above only. Severe anaphylactic reactions followed the conjunctival and subcutaneous injections and rapid improvement ensued with final vision R.E. 3/10 and L.E. 1/10.

After a contusion **Bollack** found at first an irregularly round grey spot of edema below and outside of the macula, after whose absorption a hemorrhage of more than disc size became visible. In place of the hemorrhage an area of slight depigmentation with possibly some depression appeared crossed by a curved whitish orange elongated spot with raveled out ends and a slight fusiform swelling in its lower part. Finally the spot cleared and became surrounded by pigmentation. Because of the deep position of the focus Bollack believes that a sclerochoroidal lesion with a tear in the sclerotic existed. In the discussion Magitot, Jocqs and Velter doubt the existence of a scleral rupture and assume hemorrhage between retina and pigment epithelium, rupture of the inner membranes or posthemorrhagic atrophic lesions.

The preretinal hemorrhage in **Guist's** patient remained uniform for some time but changed into a soft mass which ultimately became absorbed.

In a girl with purpura hemorrhagica **Wessely** found hemorrhages alongside of the retinal vessels, on and near the disc, also extensive choroidal hemorrhages. In another case of purpura he found atrophy of the optic nerve following great loss of blood. **Ginestous** reports intraocular hemorrhage and hemophilia cured by hemopoietic serum; and retinal hemorrhage with malaria and contraindication for preventive vaccination.

TUBERCULOSIS.—Remarkable success with tuberculin treatment and blue ray applications are reported by **Schieck.** In a case of severe left neuroretinitis in a man aged 30 years with old disseminated choroiditis the edema of the disc and the white extensive masses in front of the blood vessels and the star figure in the macula that had developed disappeared and the former vision of fingers at two meters became 5/7. In a man aged 27 years bilateral typical periphlebitis of the retina with star figure in the macula completely disappeared leaving vision 5/10 and 5/12. Two years later the patient developed right vitreous opacities and neuroretinitis. These good results Schieck considers as the result of a local active hyperemia produced by the tuberculin and the best results are seen when injection is followed by hemorrhage; the doses of tuberculin should be big enough to produce a visible hyperemia without leading to severe local reactions. Compared with parenteral milk injections tuberculin has the advantage of attacking only tubercular tissues. In the discussion Stock warns against hasty conclusions as to the value of any remedy owing to the variable course of the disease and only experiments on the animal prolonged over several years can be the deciding factor.

The right eye of a woman with retinal tuberculosis, aged 33, the patient of **Finnoff** showed in the macula a flat white exudate and a fine granular hemorrhage, the lower temporal vein was distended and in the extreme temporal side of the fundus a white exudate bordered by a narrow hemorrhage covered one of the peripheral branches of the lower temporal vein; a similar exudate above the first one covered the terminal branches of the upper temporal vein; the vitreous was hazy on the temporal side. An oval yellowish exudate which appeared later in the region of the physiologic excavation was ultimately replaced by a band of retinitis proliferans which extended on the temporal side to the inner bor-

der of the macula. Small doses of tuberculin were given.

In Camp Travis **Stark** found several cases of eye tuberculosis among the soldiers. Of these Case III showed in the temporal side of the left fundus a white triangular exudate of disc size; near it were numerous small round hemorrhagic spots covering an area about eight times the disc; in the temporal periphery fine old pigmentation was found Increase of the hemorrhagic spots followed an injection of tuberculin, and rapid improvement resulted from tuberculin injections with final normal vision. In the right eye of Case IV a white exudate about ¼ the size of the disc was found slightly above and to the nasal side of the macula. Rise in temperature, focal and local reactions followed tuberculin injections. In the right eye of Case V two light brown patches of choroiditis were seen between disc and macula with a few spots of pigment at the edge; near the large areas were several small white spots. Tuberculin injection produced decided local and slight focal reactions. Tuberculin treatment was started. In Case VII white spots floated in the right vitreous; in the nasal part of the fundus was a flame shaped white exudate. On account of active lung condition only very small doses of old tuberculin were given. In the right eye of Case VIII a large white spot of inactive choroiditis was seen in the nasal fundus. Above and to the nasal side of it was another one; between the two ran a line of white exudate over the retinal vessels, like in retinitis proliferans. In the temporal fundus of the left eye was a large white elevated spot of choroiditis apparently inactive and covered with exudate. The disc showed a white exudate. Tuberculin injection was given but the result is unknown.

Two cases of retinal tuberculosis are mentioned by **Wilmer** in a paper on the effects of the various toxemias upon the eye. The first case was that of a healthy young man with thrombosis of several venous branches, perivasculitis and hemorrhages in the right eye and a scar above the macular region with a dense band of fibrous tissue in the vitreous (retinitis proliferans) of the left eye; several von Pirquet tests were negative but a subcutaneous injection of tuberculin gave focal, local and general reaction and the patient improved under tuberculin treatment The second case was that of a woman aged 26 with numerous greyish streaks following the arteries in the right eye and similar streaks in the periphery of the left one. Focal local and general reactions followed tuberculin injection, treatment with which gave marked improvement.

In the macula of **Thompson's** patient an irregularly pigmented focus of chorioretinitis was seen. On the temporal side of it were several minute white spots with hemorrhages. In the upper part of the fundus were patches of yellowish exudate and old hemorrhages; here the retinal vessels seemed raised. The patient had been under treatment for lung tuberculosis for several years and experienced an exacerbation recently. See also Axenfeld, under Pathology; Fuchs, under Pathology; Zentmayer, under Hemorrhage; Davis, under Hemorrhage.

Proliferating Retinitis.—The patient of **Harrington** with proliferating retinitis had become blind suddenly in the left eye eight months before. The left fundus showed a large crescentic line running from below the disc, across the disc, and branching off into a Y-shaped affair at the temporal disc margin; many hemorrhages were present but none in the macula. About three months later the hemorrhages were absent, the white band projected into the vitreous about 6 D and a fine blood vessel crossed the band close to the disc.

In the left eye of his patient who gave the history of an injury, **Bell** found proliferating retinitis in the form of a white shiny connective tissue mass into which blood vessels ran extending from the retina into the vitreous.

An unusual form of proliferating retinitis in a woman, aged 28, with negative history who discovered the bad sight of her right eye six years before,

was demonstrated by **Peter.** The temporal half of the disc was atrophic, the macular arteries were very small and a large atrophic area, surrounded by pigment, was found below and including the macula and extending toward the disc. A diaphanous, bluish grey ring the width of the central retinal artery passed around the disc and blended below and to the nasal side with the retina; the ring was lying in front of the retinal vessels and was best seen with plus 4 and is looked upon as a tearing away of the anterior limiting membrane of the retina or the posterior limiting membrane of the hyaloid undergoing a proliferating process.

Fracture of the external wall of the orbit by a bullet without entrance of the bullet into the orbit itself, tear in the macular region and proliferating retinitis were found in the case of **Gonzalez.** The tear in the macula was caused by an indirect jar, the proliferating retinitis was a secondary lesion.

A typical case of proliferating retinitis was seen by **Addario La Ferla** in a soldier aged 23 years two years after hemorrhages had been found in each vitreous following an explosion of a hand grenade near him. Tho vision improved to one-half shortly after the traumatism, proliferating retinitis ultimately developed. White bands were found to extend from near the discs to points in the periphery of the retina; most bands passed in front of the vessels; some floated freely in the vitreous with their club shaped ends; others ended in a thin membrane in the periphery. No cause for the condition could be found aside from the traumatism. Intraocular hemorrhage is the basis of the production of the white bands of proliferating retinitis. See also Brearly, under Thrombosis; Zentmayer, under Hemorrhage.

Arsenic Retinitis. — During two years **de Haas** found among patients suffering from affections of the retina and optic nerve, arsenic in the urine 55 times. The most striking case was that of a woman with central recurrent superficial retinitis caused by arsenic spread on the floor as rat poison and from arsenic containing wall paint. The patient improved each time when living away from her home but the retinitis recurred when arsenic was used by her dentist in filling a tooth and another time after abundant intake of Vichy water. The affection of the retina and optic nerve by arsenic is an affection of the peripheral optic fibers, a retinitis usually preceding. In the retina superficial slight changes, at times none whatsoever, at other times only on the disc are found. These changes produce local fields defects but rarely blindness. In long protracted cases small pigment changes in the retina, in old cases chorioretinitis is found. Hemorrhages were slight and around the disc. The papillomacular bundle is easily affected and atrophy of the temporal part of the disc or the whole disc may occur. The blood vessels do not change. From the literature nine cases of arsenic affection of the eye are collected, in seven of which arsenic was taken as medicine or poison, in the other two the arsenic came from the wall covering. The normal urine contains no arsenic and an arsenical neuroretinitis exists. Prophylaxis is of greatest importance, quoting as an example in which the arsenic in an institution containing several hundred inmates, came from the zinc of the cooking utensils. Just as Society has taken measures against possible lead poisoning so must we guard against arsenic poisoning. New investigations as to the permissible quantity of arsenic in wall paper, paint, etc., are necessary.

Renal Retinitis. — Adopting the classification of renal affections of Vollhard and Fehr, published in 1914, **Hansen** and **Knack** report in detail the cases of renal retinitis in the Hospital Hamburg-Barmbeck. In a table the differential diagnostic symptoms for the three groups of this classification are given: 1. Primary degenerative affection, nephrosis; 2. Primary inflammatory affection, nephritis; 3. Kidney affections in which vascular sclerotic processes are dominating features, scleroses. The clinical description and arrangement of tables of the

cases belonging in these different groups is followed by the description of histologic changes in the eye, accompanied by 15 illustrations, of 28 cases. The neuroretinitis albuminurica is, they believe, mainly an inflammatory disease of the retina, often accompanied by a similar affection of the choroid. Leber's view that the retinal changes are due to circulatory disturbance in the retinal vessels and the view of Vollhard that retinal and kidney changes are the result of an ischemia of the small vessels, are not correct since ischemia never produces an inflammation. High blood pressure, cardiac hypertrophy and renal insufficiency are the expressions of a more or less extensive affection of the kidney and an exact law of relation between these and the fundus lesions cannot be formulated. Retinitic conditions can appear with the most varied kidney affections, but a certain intensity of the kidney lesion seems to be a prerequisite. The retinitis of nephritis has no uniform cause. In some cases the same poison attacks at the same time kidney and eye, in others the retinitis depends on the nephritis and is produced by retained products of metabolism.

Three days after the onset of the trouble in the left eye of his patient, a woman, aged 42 years, **Marin Amat** found a whitish infiltration and thickening of the retina above and to the nasal side of the disc which produced a crescentic perimacular scotoma. Twenty-four hours after a subconjunctival injection of saline solution vision was worse and what had appeared as detached retina now showed as a characteristic white patch of albuminuric retinitis. Under milk diet the scotoma became smaller and the retinal lesion disappeared. **Heine** resorts to injections of milk in albuminuric retinitis. See also: Poyales, under Pathology.

Pregnancy.—The patient of **Eigler** aged 24 years became completely blind in the ninth month of her first pregnancy; convulsions occured. After Caesarian section sight improved and the hemorrhages disappeared but there were white streaks between the disc and macula of the right eye.

The retinitis developed in the two cases of **Couvelaire,** both healthy women, during the first part of the pregnancy. If medical treatment is not promptly successful, pregnancy is to be terminated at once even where no hyperazotemia exists. Recurrence in later pregnancies is frequent but not inevitable. A compilation of twenty-three cases shows that nine of these died during or soon after another pregnancy while five became blind during a subsequent pregnancy. In five other cases there was recurrence but the women recovered. Of these two had the pregnancy artificially interrupted. Only five of the whole group had no return of the retinitis tho two of these had albuminuria. During a new pregnacy the patients should be watched by an ophthalmologist.

Diabetes.—In diabetes the retinal hemorrhages are apt to be guttate rather than flamed shaped, **Garrod** declares, and the white spots more opaque and well defined, scattered and less around the macula. He suggests that both diabetic and albuminuric retinitis are associated with high blood pressure and arterial changes. In the discussion Foster Moore declared that diabetics tended to develop hemorrhages into retina or vitreous; the prognosis of retinitis in diabetes was much less grave than in renal retinitis.

The lesions in the retina may be the first symptoms of diabetes **Coutela** reminds us. He quotes the fact that Onfray found hyperviscosity of the blood in nine out of fifteen cases and hypoviscosity in two. Hyperviscosity and high blood pressure predispose to retinal hemorrhage. The prognosis of albuminuric retinitis is more unfavorable than that of diabetic retinitis, but the outlook for vision is worse with diabetes.

Botulism.—Aside from the classic symptoms of botulism **de Saint Martin's** patients, four men, developed extreme and persistent congestion of the papilla and retina, with amblyopia. These were still evident six months after, as also considerable contraction

of the visual field for white and even more for colors, but there was no scotoma or imperfect discrimination of colors. These long lasting opthalmoscopic findings may aid in the diagnosis of botulism at the time and even months later.

APHYKIA. — Commenting on the paper of Smith and Shastid on "aphykia" of the retina (Y. B. 16, p. 165), **Blaauw** remarks that it cannot be proven that the retinal pigment had been absorbed, since all degrees of visibility of the chorodial vessels exist. Even the anterior half of the eye frequently shows permeability to light (of transillumination) and he would favor the term suggested "leucosis retinae" rather than "aphykia." He further states that it is an unproven assumption that "wearing of spectacles ——stimulate the formation of visual purple."

TRAUMATISM.—In his study of chorioretinal war lesions without apparent injury to the globe, **Mangini** found them in 6% of the eyes wounded. These lesions are produced either by direct contusion or thru contrecoup and can be divided in the following manner: (a) Retina: detachment, rupture and fibrous proliferation: (b) Choroid: rupture of the capillaries producing hemorrhages, typical complete rupture, atrophy of the choroid. His 24 cases he classes: 1. retinal detachment; 2, old healed detachment and proliferating retinitis; 3, choroidal ruptures; 4, hemorrhages and resulting lesions; macular, equatorial and disseminated.

FOLDS OF THE RETINA.—In a boy aged 11 years who had cellulitis several weeks previously, **von der Heydt** observed wrinkles in the form of vertical folds in the left macula. Vision was normal and no metamorphopsia existed. Vogt's similar observation is mentioned. See also Vogt, under pathology; Peter, under Proliferating Retinitis; Feingold, under Peripheral communicating vessels.

CHORIORETINITIS.—In a healthy girl, aged 17, who complained of sudden blindness of the right eye, **Weisenberg** found an extensive milk white opacity with many hemorrhages around the white, glistening and 3 D. elevated macula, in the center of which a horizontally oval bright lemon yellow could be seen. This yellow area became gradually smaller and disappeared entirely about four weeks after onset of the trouble. The white color of the retina and the hemorrhages disappeared, some of the vessels became obliterated, while one upper temporal vessel developed a hose like thickening; the macula became white, tendinous and folds appeared in the retina. The case is classed as a retinitis exudativa externa hemorrhagica, but it is the only acute case on record. Yellow color of the macula has been reported in embolism of the central artery, thrombosis of the vein, exudative retinitis and injury by Dimmer, van der Hoeve, Harms, Ejler Holm and Koeppe.

The interesting feature of the case reported by **Finlay** is that a bilateral macular affection developed after several attacks of what appeared retrobulbar neuritis due to tobacco. The patient first came under observation in 1912 when 53 years old with symptoms of tobacco amblyopia (lowered vision, central scotoma for red and green): improvement soon followed. Two years later the symptoms returned and treatment had some good affect. About five months after this, in spite of abstinence from tobacco, the subjective symptoms returned; but this time the disc margins appeared blurred, the retinal veins were dilated, and the maculae showed some loss of transparency. Treatment as formerly used gave a slight improvement. Soon degenerative changes at the maculae were established by the consultant, de Schweinitz, due to intestinal stasis in the dilated colon. Treatment for this was followed by improved vision and the macular changes were scarcely noticeable in 1915. In 1917 complaint similar as before; this time the trouble was diagnosed, by Cutler, as central chorioretinitis caused by an apical abscess. Treatment with an autogenous vaccine from the extracted tooth was begun and rapid improvement followed. 1918 return of former symp-

toms; the degenerative changes in the maculae Finlay now blamed on the dilatation and sagging of the transverse colon. Treatment for this was ordered and vision improved. Even after the appearance of the macular changes no pallor of the temporal part of the disc could be seen. Finlay believes that the macular lesions, probably on the basis of arteriosclerosis, developed under the slightest variation from the normal of the vascular supply produced by certain toxins or poisons, the disturbance being at first purely functional. The success of the various forms of treatment is to prove the different etiology of the attacks.

At present chorioretinitis seems to occupy the center of interest, according to **Abadie.** Aside from the well known forms of chorioretinitis a form exists with diffuse infiltration and without any distinct patches and pigmentation. The inflammation may extend to the optic nerve and produce atrophy which is characterized by the grey color of the disc, the thinness of the veins and arteries, and by the fact that the few foci are only at the periphery and thus easily escape detection. Complications of chorioretinitis are: glaucoma, hydrophthalmus and detachment. All these conditions can be cured by intravenous injections of cyanid of mercury, provided the treatment is used continuously and not as heretofore, in short periods and stopped if no immediate success is attained. Abadie advocates injections of cyanid of mercury every other day over a period of years; these injections are to be stopped only for a week or two in case of diarrhea or jaundice. In support of his contention of long and continued treatment he cites the following: A woman aged 42 with bilateral chorioretinitis whose vision had been failing for eight years to 1/100 regained vision of 1/15 after four years of continued treatment. A similar result was obtained in a man aged 43 and in a case of hydrophthalmus. **Henderson** reports a rare bilateral chorioretinitis in a child. There was no family history of tubercle or other hereditary complaint, and the condition was thought to be due to some unexplained choroidal vascular lesion. **Michael** reports hereditary pigmented chorioretinitis.

A man, aged 25 years, **Shields'** patient with guttate choroiditis, had failing vision of the left eye. The fundus showed a number of small whitish spots situated around the macular area especially between macula and disc. Vision 5/10.

Circular Chorioretinal Atrophy.—In a man aged 53 **Masuda** saw a band like atrophy of the choroid which beginning at the disc and running behind the retinal vessel surrounded the macula and produced a ring scotoma. It was probably caused by vascular sclerosis and circular chorioretinal atrophy is the term proposed for it. **Zeisler** reports macular atrophy following syphilis.

Neuroretinitis.—While the vision of her right eye was still almost normal and the disc edges appeared only slightly blurred, **Augstein's** patient, aged 21, already had a negative ring scotoma below for white and colors. Physical examination was entirely negative but for decided *chlorosis.* Rapid deterioration of vision occurred in the next two weeks, the scotoma formed a complete ring, severe neuritis developed and a marked star figure appeared in the macula; during all this time pressure on the bulbus emptied the retinal veins and produced venous pulsation on the disc. Daily subcutaneous salvarsan injections, internal thyroid medication (because of thyroid enlargement) and alpine light treatment were followed by rapid disappearance of the objective and subjective symptoms.

In his two cases of unilateral neuroretinitis with star figure in the macula, socalled pseudonephritic neuroretinitis, **Neubner** found as the exciting cause a fragment from a grenade in the orbit of the same side in the one case, and a furuncle on the temple of the opposite side in the other case. Both cases recovered and in the first case two concentric white reflex lines appeared around the disc marking the limits of the former swelling in the

retina. From these cases and those in the literature these conclusions are drawn: The star figure is a symptom of no characteristic diagnostic value; it is mostly a consequence of a rapidly passing circulatory disturbance in the optic nerve or the surrounding retina, and the presence of an inflammation is not essential. Among other causes embolism in the optic nerve, or lesions of its coverings from inflammatory processes are etiologically important.

Pigmentary Degeneration.—Typical pigmentary degeneration of the retina must not be attributed to syphilis, even if an occasional patient has been found to be syphilitic, **Hirschberg** declares. Such patients may acquire syphilis as any other individual. Since the literature contains only one case, that of Lafon, Hirschberg details his own observation of a patient with typical pigmentary degeneration who subsequently acquired his syphilis. The patient, whose two sisters also had pigmentary degeneration, first came under observation when eleven years old with the first beginnings of the affection and was seen at various intervals to his 47th year. Vision, fields and fundi have gradually deteriorated. The primary sore was acquired at the age of 22.

After a detailed review of the literature, **Zorn** reports an instance of familial atypical pigmentary degeneration, found among the members of three generations of a family. The grandmother, who is known to be hemeralopic, could not be examined; of her three children one daughter said to be unaffected, could not be examined. The son had bilateral atrophy of the choroid, the fundi at the disc appearing almost entirely white containing black pigment deposits; vessels belonging to the sclera could be made out distinctly; only the maculae appeared more red and contained a central pigment lump; choroidal vessels could be seen only in the maculae and in the periphery of the fundi, tho even here atrophy of the choroid was apparent. The other daughter had concentrically contracted fields with normal vision, hemeralopia and indistinct yellowish white foci and pigment accumulations. Of the son's seven children the six younger ones are reported to be unaffected and the oldest girl only, aged 13, could be examined, who showed hemeralopia with normal fundus. The affected daughter's son, aged 9 years, had partially interrupted choroidal circulation around the discs, fundi rather poor in pigment with fine and larger pigment lumps in the periphery. One son of the unaffected daughter, aged 16, had hemeralopia with atrophy of the pigment epithelium and pigment accumulation in the periphery some of which had salt and pepper appearance; two daughters and another son supposed to be well could not be examined.

Advocating eugenic measures to prevent the ill consequences of marriages of blood relatives and of marriages of individuals having a hereditary taint or transmissible disease, **Lanier** reports on 3 families in which retinitis pigmentosa occurred among the male members of each family, while the females all had perfect eyes. In two of these families the parents were blood relatives—first and second cousins. **Hansen** writes on dementia precox and retinitis pigmentosa and **Knorr** on retinitis pigmentosa.

Retinitis Punctata Albescens.—Retinitis punctata albescens was found by **Healy** in a man aged 23 who always had difficulty in seeing in the dusk and also suffered from congenital deafness. His mother, a younger brother and several members of his mother's family had similarly defective vision. Vision was 6/12 and he had to find his way in the darkened room by groping. The fields were contracted. Each fundus showed, as well shown in the colored drawing, hundreds of whitish, yellow opaque spots, apparently in the deeper layers of the retina or in the lamina vitrea; they were most numerous in the equatorial zone, less in the periphery, absent from the macula and more numerous again around the disc. Four or five branched collections of pigment were seen along the veins in the equatorial zone. The discs were dirty greyish. Healy finds some fea-

tures of pigmentary degeneration in his case and thinks it is probable that the pathologic process underlying the two diseases is a perivascular degeneration of the choroidal end vessels with consequent atrophy of the highly developed retinal and optic nerve tissues.

Oguchi's Disease.—With an adaptometer built according to the principles of Nagel, **Nakamura** undertook measurements of the dark adaptation on a patient with Oguchi's disease, who showed the phenomenon of Mizuo consisting in that the peculiar coloring of the fundus of this disease disappears after light bright occlusion of the eye. (Y.B. 15, p. 154.) He found that the dark adaptation, which at first had remained stationary, began to advance suddenly after 1½ to 2½ hours and that the fundus had assumed the normal color (Mazuo's phenomenon) while the patient stated that vision in the field beyond the area of fixation had improved and the pupil of this eye appeared much smaller in the light than the other one. A hypodermic injection of adrenalin, after the light sensibility had reached a high value and the fundus appeared normal, reduced the light sensitivity and the fundus looked yellow with dark vessels. This is assumed to have some relation to the color changes of the retina of the dark adapted frog.

Central Retinitis.—In his new communication on central retinitis, **Masuda** declares that the macular region in this disease so often seen in Japan appears either normal or diffusedly cloudy, the latter especially, when examination is made with the Thorner or Gullstrand ophthalmoscopes. Occasionally a yellowish white focus or several yellow white spots are found. In fresh cases a central black spot is complained of, in older ones a marked loss of vision exists. Two kinds of micropsia are found: if noticed by the patient, the objects are seen as if far away; the prognosis in these cases is less good, the complaint continuing for a long while, in spite of other symptoms having already disappeared. If the micropsia is only elicited by examination, the prognosis is much better. Visual acuity is generally improved by a convex lens. The Wassermann reaction has generally been found negative.

Amaurotic Idiocy.—Typical amaurotic idiocy was found by **v. Starck** in three girls the first, fourth and fifth children of healty non-Jewish parents whose other two children, boys, were healthy. **Clarke** also writes on amaurotic idiocy.

Retinitis Exudativa Externa (Coats).—Two cases of elevated large white hemorrhagic foci in the macula are classed by **Stargardt** as retinitis exudativa hemorrhagica externa (Coats). See also Crigler, under Pathology.

Macular Degenerations.—On the basis of the different forms of familial macular degeneration, a detailed report of which he gives, observed in the Kiel Eye Clinic during the last ten years and on the cases in the literature, **Behr** creates the picture of heredodegeneration of the macula which is to comprise all affections having in common a degeneration of the macula and familial or hereditary characteristics. This clinical entity shows the following peculiarities: The disease is familial or hereditary; the fundus changes are, with rare exceptions, always bilateral and greatly symmetric in the two eyes. Several family types exist which are typical for all affected members of a family. The family type is principally characterized by the time of the appearance of the disease and its course. The onset favors those ages which separate the different periods of life: at the beginning of the extrauterine life, congenital; at the sixth to eighth year, time of the second dentition; about the fourteenth year, the time of beginning puberty; at the twentieth year, the time of completed skeletal growth and puberty; at the fiftieth year, the time of beginning senile involution; and finally in old age (Haab's senile macular degeneration), as a premature sign of impending death. Most cases are of the infantile and juvenile types. The affection is slowly progressive, without

leading to complete blindness, or becomes arrested after a short time; in these last types improvement of function may occur. The time of appearance and the course of the disease are always the same in each affected family; several different types of the disease in the same family have so far not been observed; time of onset and course of the disease are not cardinal symptoms of the affection, but represent purely peculiarities of the particular family type. The heredodegeneration is either familial in several members of a childship (collateral—latent inheritance) or is transmitted by direct and indirect inheritance. In this last form the transmitting women are themselves affected, while the transmitting men are as a rule unaffected. The macular heredodegeneration has great tendency to be complicated by other hereditary affections of the neurooptic apparatus; no family types exist in these combinations. Complications with disturbances of color vision are the most frequent; combination with partial or complete atrophy of the optic nerve, with pigmentary degeneration of the retina and with an affection of the extramacular retina resembling honeycomb choroiditis are found. These combinations are purely complications and are only an expression of the greater tendency to degeneration of the parental germplasm. But not each degenerative change complicating macular degeneration is to be considered as a hereditary affection, even when appearing familial, as shown by an instance of complete color blindness in two brothers whose bilateral optic nerve atrophy was not hereditary but due to congenital lues.

A patient with bilateral symmetric coloboma of the macula about 1.5 d.d. in size, with well defined edges and an excavation of about 3 D was presented by **Appleman.**

Symmetric macular degeneration in a man aged 28 and his sister aged 24, the fourth and fifth children of Irish-American, nonconsanguineous parents, is reported by **Chance.** A maternal aunt with strong eyes showed between right disc and macula three bright glistening areas; other members of the family have not been examined. The eldest brother has one poor eye. The patients attended school until about 14 years old; the sight was defective from the tenth to the twelfth year on. Both had defective color vision which was quite marked in the girl. Fields were contracted. The fundus was very much alike in both, and both patients showed in the macula a disc shaped area of distinct absorption of the retina, bordered by pigment; the choriocapillaris was exposed, the border around the area was slightly elevated making the area somewhat craterlike.

Macular Hole.—The hole formation in the macula found by **Masuda** in a girl aged 22 is considered by him as spontaneous and due to choroidal circulatory disturbance since the eye also showed an old iritis.

The terms "macular hole," "macular degeneration," etc. are unscientific, **Brav** declares, and should be replaced by the term "retinitis disciformis" which would at once indicate that we are dealing with an inflammatory process, a fact of which he is convinced. His patient, a boy 9 years old, showed in the right macula a disclike red sharply defined area, lying below the level of the retina and surrounded by a ring of yellowish spots. Patient's mother and sister, aged 4, were very near sighted.

Total loss of vision of the left eye and a round red disc in the macula simulating a hemorrhage with very sharply defined border was found in **Guttman's** patient who attributed his affection to a fall from his bicycle when the right side of his head struck the pavement.

Contusion of the eye in childhood led to the hole formation at the macula in the case of **Gonzalez.** The lesion appeared pear-shaped, about ⅔ d.d. large. Illustration and analysis of 79 cases in the literature form part of the paper.

Among 2,400 military persons **Salzmann** observed 8 typical cases of hole formation in the macula from war injuries; these were produced twice by

bullets, three times by shrapnel and three times by grenade explosion. In all but one case the hole formation was found at the first examination. In all cases the foveal condition was typical and the area around the hole always appeared somewhat veiled and opaque as compared with the bottom of the hole.

DETACHMENT.—The theory that paralysis of secretion of the aqueous humor is the cause of detachment, as advocated by him in 1912 (Y.B. 10, p. 235) is now elaborated by **Vail.** Disease of the pars ciliaris, anterior or equatorial choroiditis is the essential factor predisposing to detachment. If, from any cause, the ciliary processes are damaged from progressive disease, a slight insult like dazzling, straining, etc., will result in little or no aqueous being secreted. Normal tension being thus lowered the choroidal vessels become hyperemic, allowing serum which is probably hypertonic compared with the vitreous, to pour out between retina and choroid, stripping the retina of its bed and even bursting it at times. Vail expresses the hope that "the active ferment, hormone, or zymogen which incites the flow of aqueous may be discovered, extracted and used" to restore the secretion. Our aim in the treatment ought, therefore, be to establish a hypertonic vitreous and hypotonic subretinal content. Trephining may cure by draining the subretinal fluid thus making the osmotic pressure in the vitreous greater; subconjunctival injections lower the subretinal pressure; pilocarpin increases aqueous secretion and atropin diminishes the outflow of the aqueous, both thus increasing the intraocular tension. All attempts to produce adhesions between retina and choroid thru scar formation are to be condemned.

Is the prognosis of detachment really so bad as the statistics of Vail (Y.B. 10, p. 235) would teach us, **Darier** asks, and how can we harmonize those figures with the experiences of Deutschmann (Y.B. 16, p. 192). Of his own 108 cases seen from 1893 to 1913, 60 underwent treatment. Of these ten were cured and 20 improved. During that time his treatment consisted of subretinal injections of iodin, electrolysis and intravitreous injections of air or saline solution. Since then he only uses sclerotomy or simple puncture with subconjunctival injections of hypertonic saline solution and the results are even better. Detachments that heal are: 1. Traumatic detachments; 2. Recent detachments when only ⅓ or at most ¼ of the retina is involved and when the myopia is less than 12 D; 3. Detachment with or without tears which accompany more or less pigmented foci and long striae of choroiditis; syphilis or tuberculosis may be the causes for the choroiditis and he uses for these intravenous injections of salicylarsenat of mercury and subconjunctival injections of 2% guaiacol. Seven cases were cured in this more simple manner and 11 improved out of a total of 43 cases; of the others some have not been observed sufficiently. The details for the subconjunctival injections are the same as previously given (Y.B. 15, p. 159).

In his paper on treatment of iridochoroiditis **Darier** mentions a case in which detachment followed extraction of cataract of the one eye after the iridocyclitis had been cured while the extraction passed without any such incident in the other eye.

A new report on the results after trephining and aspiration as proposed by himself and Curtin in several previous communications (Y.B. 13, 218, Y.B. 12, p. 204) is given by **Thomson.** Of seventy-five cases operated until now, seven were successful, some with most excellent results; the remaining cases were failures but almost all improved temporarily. At present trephining and aspiration are done at the same time otherwise no change has been made in the operation. In one case detachment had existed for seven months and the field ultimately became normal. It is useless to operate when a retinal rent exists. All subretinal fluid should be removed at the time of the operation even if the globe collapses markedly, tho a secondary operation may be successful. Myopia may diminish 2 D. after trephining, but

recurs. Fluid in the subchoroidal space is a favorable sign. Trephining seems to hold off the iritis complicating detachment. Infection does not occur because of the thicker flap. It is a mistake to overdo the period of rest in bed. In the discussion Curtin mentioned the inability to find a cause for the choroiditis mentioned by Vail and alluded to the results obtained by trephining, Lambert mentioned a spontaneous cure of detachment following cataract operation and Davis spoke of his only two cases of reattachment in one of which white lines marked the place of the former detachment.

Since the report of his results with Mueller's resection of the sclera in 1917 (Y.B. 14, p. 120), **Török** has operated on ten more eyes, making in all twenty-one cases. Deducting the first six cases from his statistics because they were failures on account of lack of technic, he gives detailed data about the remaining eleven, all operated in the manner previously described. The patients were under observation after the operation from three months to five and one half years. In no case was permanent total reattachment obtained, but all were greatly improved immediately after the operation at which time no detachment was found in most cases. A certain amount of detachment returned, usually in the lower periphery to remain stationary. The best results were had in detachments of a few weeks standing, older cases are less favorable, as are also detachments in the macular region. Operation is, therefore, to be performed early. The only disadvantage is that the operation is highly technical. A preliminary Kroenlein is superflous. Vision after reattachment cannot be very good because of the conditions existing prior to the detachment.

In his report on detachment of the retina at the French Ophthalmological Society, **Gonin** declares that the clinical examination of cases of idiopathic detachment gives data of importance as to cause of the detachment. It generally begins above, the tension is lowered, one or more tears exist, vitreous opacities and retinal pigmentation are present. As to the theories of the detachment (Y.B. 16, p. 161, 190) he cannot accept the distension theory except for cases of traumatism, nor does the exudation theory seem acceptable except for the cases of slow development. The traction theory, according to which shrinking of the vitreous produces tears of the retina that allow the vitreous to escape into the subretinal space, seems to be applicable to most cases. The traction is exerted on the anterior surface of the retina, in the periphery. Exudation from the choroid is a secondary phenomenon. Retraction of the vitreous is not the result, as described by Leber, of fibrillary degeneration of the vitreous but is most probably produced thru penetration by epithelial cells from the uvea. The primary cause of all this must lie in an equatorial choroiditis, syphilis, tuberculosis, ectasia of myopia or senility. As to secondary detachments, that of hydrophthalmus is of the same kind as in idiopathic detachment, only participation of the uvea (exudation and secondary glaucoma) is the rule; detachment following hemorrhage into the vitreous is secondary, produced by formation of membranes or adhesions of the vitreous to the retina; in detachment following vitreous abscess it is difficult to decide whether the choroidal exudate is primary or secondary to the shrinking of the vitreous; after inflammations of the coats of the eye or of the surroundings, in disturbances of the circulation (retinal or general) and in detachment of retinitis exudativa the detachment may be due to choroidal exudation or to serous exudate given off by the retina itself. In the discussion Terson thought it best to drop the term "idiopathic" altogether and to substitute for it the term "cryptogenic" which would at once tell that the etiology is unknown; the exudation theory, he says, must be thoroly studied with all modern means, in its relation to general and local affections and thru experimental study; only this way better therapeutic results can be had. Dor believes that the retraction of the vitreous is secondary to toxic affections of tubercular or dental origin and

that trivial influences such as a cold or traumatism lead to detachment. Sourdille finds that the retraction of the vitreous cannot explain the tears in the retina and the reattachment; changes in the pigment epithelium play a part in the genesis of detachment. Kalt showed an eye with numerous cysts and a punched out hole which apparently developed from a cyst; he believes that this mechanism is quite frequent in the production of a communication between vitreous and subretinal space.

Gonin's views on detachment are not satisfactory to **Jocqs.** They would lead to therapeutic nihilism which cannot be accepted by those who have had successes with their treatment. It is much more logical to assume that the subretinal fluid is the product of a vascular disturbance in the choroid; the subretinal fluid is not vitreous. The detachment yields to similar treatment as pleurisy and hydrarthrosis: to puncture and to procedures promoting osmosis. Subconjunctival injections and puncture have been beneficial in his cases. For detachments following hemorrhage into the vitreous or iridocyclitis, changes in the retina and vitreous can easily occur as described by Gonin.

In his discussion of the causative relation of accidents to detachment, **Ammann** starts from the fact that severe contusion of the bulbus as cause for detachment is not to be doubted. But the question is not settled in cases of slight direct contusion of the bulbus, in concussions of the head, concussion of the whole body and in cases of stooping, lifting of heavy weights and straining of the abdomen. This question is especially difficult to settle because of the spontaneous detachment and because of the very severe contusion that the eye will occasionally stand without any detachment resulting therefrom. A disposition to detachment must in all cases be assumed. Quoting his own and cases from the literature, Ammann comes to the conclusion that in all probability a relation exists between accident and detachment, that detachment has been seen to occur after hyperemia of the head and after physical exertion. But the full compensation should not be paid in these cases and the percentage of it will have to be agreed upon.

Utilizing the subjective sensations produced by the movement of his vitreous opacity by the jolting railway carriage and facts from two cases of indirect trauma, **Brueckner** attempts to estimate the force which would be sufficient to produce detachment of the retina and arrives at the conclusion that it must be at least 20 to 50 ergs per square millimeter of retina but is most probably decidedly higher.

Giving an example each of idiopathic detachment in which the upper part is first affected, of detachment in the lower half involving the macula with fairly useful vision and one of long standing detachment with good vision and a possible traumatic element, **Killick** adopts the views of Gonin. As long as the vitreous is healthy, idiopathic detachment does not occur. In traumatic choroidoretinitis proliferans detachment occurs only rarely according to Wallace. Detachment after escape of vitreous in cataract extraction is also rare. In detachment due to choroidal effusion as in trauma, albuminuria, after trephining, etc., the prognosis is much better than in idiopathic cases. Prophylaxis will have to be developed to guard against idiopathic detachment.

A new case of detachment with circular retinal folds, the result of contusion of the posterior part of the eye by windage, **Frenkel** reports in a soldier, aged 29, who had been injured several times. The right lens showed a subcapsular opacity. In the left eye several detachments were seen: 1. Around the disc, of ovoid outline; 2. Above, with a semicircular line of large radius and in places showing double contours; some pigmentation near the detachment; 3. On the nasal side, a less typical, partly raised detachment; 4. Below and to the nasal side, incomplete circle of detachment. Tho the date of the onset is unknown to the patient, it is probable that the disease dates from the windage about

three years before which also led to an otitis media; this injury may have caused also the subcapsular opacity of the right lens. The first patient reported (Y.B. 1917, p. 106) shows no changes in the fundus condition but glaucomatous excavation of the disc has developed. This form of retinal detachment seems to have the tendency to remain stationary; in the first case it has remained so for four years and two months and in the present one it is apparently about three years old.

On 46 eyes with detachment of the retina **Kuemmel** investigated the tension and found 39 times diminished tension. Diminished tension was found in all the 16 fresh cases; in the 5 cases with equal tension on both sides the detachment had been present at least six months. Slightly increased tension was found in two cases of several weeks duration. In one instance diminished tension was noted a few days before the detachment had developed. In suspected sarcoma diminished tension was found once. This diminution of the tension indicates that all tension reducing procedures must be avoided; Birch-Hirschfeld's injection of the subretinal fluid into the vitreous seems useful and Lagrange's pericorneal scar-formation has to be tried out. In the discussion Schreiber mentioned that he had found marked diminution only in advanced cases, while Elschnig declared cases with low tension as prognostically unfavorable.

Relating a cure of detachment of the retina which followed evacuation of the subretinal fluid and subconjunctival injections, **St. Martin** advocates the treatment practiced by Darier (Y.B. 1918/19, p. 159). A myopic woman butcher who had lost the sight of her right eye from spontaneous detachment about five years before and was suffering from slight glycosuria experienced rapid lowering of sight of her left eye following a strain during her work. Two days later detachment in upper nasal quadrant and subluxation of the lens were found. Immediate evacuation of the subretinal fluid followed by subconjunctival injections of saline solution and acoin serum (see Y.B. 1918/19, p. 159), bandage and rest in bed. Later mercury was ordered on account of a focus of choroiditis found in the periphery. Reattachment occurred which was still present about two months later. Deutschmann's advice to wait in fresh detachments until the detachment occupies the lowest point, St. Martin finds surprising and advocates to attack the detachment in whatever place it is found.

In a boy of twelve years whose left eye had been blind from detached retina for two years, **Wood** found in 1912 a large grey oldish detachment of the retina in the lower part of the right fundus, vitreous opacities and scarring and pigmentation in the upper and in the outer parts of the fundus. Rest in bed one week and scleral puncture produced no change in the condition and the patient was lost sight of another week later, but the retina was found reattached everywhere in 1916 and again in 1919, when vision was good enough to enable the patient to shoot partridges in spite of beginning lens changes. Cataract also appeared in another of his cases which Wood reports as an example of the method of treatment he described in 1910 and which he claims has been since taken over by Birch-Hirschfeld. In this case, that of a woman aged 42 with high myopia of the left eye, the right eye had been failing a month and a large detachment was seen below. The sclerotic was punctured and the fluid aspirated with a hypodermic syringe half filled with saline solution; the mixture of subretinal fluid and saline was then reinjected into the vitreous. A month later the retina was all in place. Seven years later tension and light projection were good but the lens was too opaque to permit fundus examination. He has used this treatment in four cases, with two successes. Only clear subretinal fluid may be injected, darkly tinted fluid is to be avoided.

Detachment of the retina beginning in the macula as an elevation of about 2 D was demonstrated by **Thompson.** Because of the unusual location of the beginning, a tumor was suspected and

during the four months of observation no increase of tension had appeared.

Of five children in a family with negative history two brothers and a sister, the patients of **Kennon,** showed detachment of the retina. In the one brother the affected left eye had been struck by an oyster shell some weeks before. The other brother had the right eye affected and gave a history of injury during football six weeks before. In the left eye of the sister whose retina was detached the vitreous contained floating opacities. Treatment was without success.

The detachment in a woman aged 60 years with high blood pressure and heart lesion, the patient of **Patterson** improved rapidly and the albumin disappeared from the urine under purgatives and plenty of water.

Immediately after extraction of a tooth, the sight of the eye on the side of the extracted tooth of **McDavitt's** patient is said to have failed. Two months later McDavitt found in the lower half of the retina evidence of it having been detached some time, altho it had been reattached. Vision was nil. In the other eye there had been a slight detachment peripherally, not sufficient to disturb vision. **Schmidt** reports chorioretinitis and detachment of retina from dipterous larvae.

From Rollet's service **Bodard** reports 33 cases of detachment following war injuries. He assumes the following ways for the development of the detachment: Hemorrhage behind the retina, retraction of the vitreous, cicatricial shrinking of wound, suddenly diminished volume of globe and tear of the retina. **Dor** writes on sclerochoroiditis and detachment of the retina, and **Phillipps** on retinal detachment.

In two girls aged 18 and 20 respectively, **Morax** observed detachment of the retina of unknown cause which was followed after some time in each case by increased tension leading to enucleation because of suspected choroidal tumor. Histologic examination showed absence of any tumor and no special characteristics of the detachment to explain the glaucoma. In one of the eyes slight symptoms of iridocyclitis were present, in the other one the angle of the anterior chamber was entirely free. Syphilis may have been the underlying cause. In the discussion Gonin declares that very often detachment is the first symptom of iridocyclitis which, thru changes in the chamber angle, produces glaucoma secondarily.

After cataract operation, in keratoconus and detachment of the retina **Mendoza** bandages the eye with a plaster of paris cast or mold of the eye and surroundings made for each individual case thus avoiding pressure, but getting a uniform grip on the organ. See also: Fuchs, under Pathology.

Congenital Detachment.—In over 62,000 eye patients **Santos Fernandez** has seen only the following four cases of congenital detachment of the retina: 1. In this case glioma had been suspected at first, but later developments confirmed the diagnosis of congenital detachment. 2. Bilateral detachment in a boy one and a half months old. 3. A girl of three years with a yellowish reflex in the right eye since she was able to see. 4. Bilateral detachment in a girl, first noticed when fifteen days old.

Current Literature

These are the titles of papers bearing on ophthalmology received in the last three months. Later most of them will be noticed under Digest of the Literature. They are given in English, some modified to indicate more clearly their subjects. They are grouped under appropriate heads, and in each group aranged alphabetically usually by the author's name in **heavy-face type.** The abbreviations mean: (Ill.) illustrations; (Pl.) plates; (Col. Pl.) colored plates. Abst. shows it is an abstract of the original article. (Bibl.) means bibliography and (Dis.) discussion published with a paper. Under repeated titles are given additional references to papers already noticed. To secure early mention copies of papers or reprints should be sent to 318 Majestic Building, Denver, Colorado.

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